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How Finnish Pension Institutions Use Derivatives?

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Master's Thesis

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Abstract
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HOW FINNISH PENSION INSTITUTIONS USE DERIVATIVES?

PURPOSE OF THE STUDY

The objective of this study is to survey how Finnish pension institutions use derivatives. In addition to instruments and strategies, this study explores the motives that are driving derivative activities in the Finnish pension sector.

Study creates new public information on these previously undisclosed activities and seeks to provide background for further research in the field. Most importantly, survey results should help Finnish pension institution managers and regulators to evaluate and develop their own derivative policies.

DATA AND METHODS

The results of this study are based on the survey "2005 Survey of Derivatives Usage by Finnish Pension Institutions" conducted as an email questionnaire supported by telephone interviews in March-April 2005. Of the 61 pension institutions in the survey population, 33 institutions with 92% of the Finnish pension assets choose to participate in the survey. Data set obtained consists of the respondents' descriptive characteristics and the frequency of their derivative usage. Respondents were also asked to indicate their agreement with various statements relating to the derivate markets and instruments. Responses are analysed using univariate tests, principal components analysis, binary logistic and OLS-regressions.

RESULTS

Survey results confirm that Finnish pension institutions are active players in the derivative markets. The results are in line with previous international studies and indicate that Finnish pension institutions are at least not using less derivatives than their international counterparts.

Secondly, this survey challenges the traditional view that derivatives are used mainly for hedging purposes. Statistical evidence is that the use derivatives is also motivated by the search for better yields and asset allocation. Accordingly, the most popular derivative strategy was the use of structured derivative products to diversify assets and/or to enhance yield to investments. This study does not find any evidence that derivatives would be used to arbitrage Finnish regulatory framework.

Finally, survey responses outline the importance of the costs involved in the derivative activities. For many institutions the decision not to use derivatives may be completely rational if the costs involved, such as lack of expertise and resources, outweigh the expected benefits, such as extra yield and asset diversification. Additionally, the decision how much to use derivatives is better explained by these perceived limitations.

KEY WORDS: Financial markets, pension institutions, derivatives, survey, questionnaire

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KUINKA SUOMALAISET ELÄKEINSTITUUTIOT KÄYTTÄVÄT JOHDANNAISIA?

TUTKIELMAN TAVOITEET

Tutkielman tarkoituksena on selvittää kyselytutkimuksella kuinka suomalaiset eläkeinstituutiot käyttävät johdannaisia. Käytettyjen instrumenttien ja strategioiden lisäksi tutkielma selvittää mitkä tekijät ovat johdannaisten käytön taustalla.

Tutkielma luo uutta tietoa toiminnasta, josta ei ole aikaisemmin paljonkaan tietoa julkistettu, sekä luo pohjaa jatkotutkimuksille aiheesta. Vielä tärkeämmin, tutkimustuloksien tulisi auttaa eläkeinstituutioiden johtoa sekä valvojia arvioimaan ja kehittämään omaa johdannaispolitiikkaansa.

TUTKIELMAN DATA JA MENETELMÄT

Tutkielman tulokset perustuvat englanninkieliseen kyselytutkimukseen "2005 Survey of Derivatives Usage by Finnish Pension Institutions", joka suoritettiin sähköpostin välityksellä maalis-huhtikuussa 2005. Tutkimuspopulaation 61 eläkeinstituutiosta 33 instituutioita osallistui tutkimukseen. Tutkimukseen vastaanneet instituutiot hallitsevat 92% suomalaisen eläkesektorin sijoituksista. Tutkimuksessa käytetty data koostuu vastaajien yleispiirteitä kuvaavista muuttujista, sekä heidän johdannaisten käytöstä. Vastaajia pyydettiin myös ilmaisemaan ovatko he samaa vai eri mieltä johdannaismarkkinoihin liittyvien väittämien kanssa. Vastaukset analysoitiin käyttämällä yhden muuttujan testejä, pääkomponenttianalyysia, sekä binaarista logistista sekä PNS-regressioita.

TUTKIMUSTULOKSET

Tutkimustulokset vahvistavat, että suomalaiset eläkesäätiöt ovat aktiivisia toimijoita johdannaismarkkinoilla. Tulokset ovat linjassa aikaisempien kansainvälisten tutkimusten kanssa, ja osoittavat että suomalaiset eläkesijoittajat eivät ainakaan käytä vähemmän johdannaisia kuin heidän kansainväliset kumppaninsa.

Tulokset myös haastavat perinteisen näkemyksen, että johdannaisia käytetään vain riskeiltä suojautumiseen. Vastauksien perusteella johdannaisia käytetään paljon myös parempien tuottojen sekä hajautushyötyjen tavoitteluun. Tutkimus ei löytänyt tukea väitteille, että johdannaisia käytettäisiin eläkesijoittajien toimintaa rajoittavan säätelyn kiertämiseen.

Tutkimus myös painottaa, kuinka tärkeä tekijä on johdannaisten käyttöön liittyvät kustannukset. Monen instituution ei yksinkertaisesti kannata käyttää johdannaisia niiden hyödyistä huolimatta, jos niiden kustannukset, kuten tietotaidon tai resurssien puuttuminen, ylittävät odotettavissa olevat hyödyt, kuten lisätuotot tai hajautushyödyt. Myös johdannaisaktiviteettien volyymi voidaan selittää paremmin näillä käytön esteillä kuin instrumenttien hyödyillä.

HAKUSANAT: Rahoitusmarkkinat, eläkeinstituutiot, johdannaiset, kyselytutkimus

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1 Introduction[1]

1.1 Research background and motivation

Internationally pension institutions have been in the focus of considerable public attention recently. After the equity market bubble of the late 90s bursted, the investment environment for pension fund managers has been rather challenging with low bond yields and dismal equity market returns. Consequently, many pension schemes are finding it overwhelmingly difficult to meet their return targets. The underfunded status of many large company pension schemes in the US is already believed to threaten the solvency of the corporate America and financial market stability (see e.g. Ryan, Fabozzi 2003). The retirement of the baby-boomers generation in near future has further outlined the need for pension reform in various developed countries.

At the same time in Finland, the pension system has increasingly shifted from traditionally pay-as-you-go scheme towards partial pension prefunding. This move has resulted in by far largest institutional investor segment with extremely large institutions that control over 88 billion euros in assets and have large impact on the Finnish financial markets. (For statistics and analysis, see TELA 2005)

Furthermore, the business of the pension institutions is quite unique in the world of finance. Finnish pension schemes are defined-benefit type by law, and they have a set of rather fixed obligations they have to meet in the future. Successful investment policy can be seen as a method to achieve returns to cut down the sponsor's contribution burden in the future, but also to manage risk of increased contributions. Pension institution management is thus asset-liability game where risks, funding status and regulations have a great impact on the investment choices.

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Another prevalent trend both internationally and domestically, has been the increasing financial sophistication of fund managers. In the US many pension institutions have turned into financial markets for solutions to better match their assets and liabilities. More or less sophisticated derivative structures are demanded to hedge various risks, or simply to enhance yield to assets in a challenging market environment. Sheer size of the pension sector has meant that pension funds can be seen as a one major driver of the financial innovation and product development. This view was introduced as early as late 80s (Bodie 1990a), but the Finnish pension institutions have been able to diversify their assets from plain fixed income instruments only after mid 90s.

As providers of future statutory pension benefits, Finnish pension institutions have an essential role in the society, and their competence and soundness are of critical importance. New financial innovations can significantly improve pension institutions asset-liability management goals, but also poses new risks and challenges that need to be addressed.

This study is motivated by the uncertainty of how these trends, i.e. increased prefunding and financial sophistication, have impacted the way Finnish pension institutions utilize financial market innovations, especially derivatives. First, it is not clear how these institutions use derivative instruments. Common public and regulatory perceptions seem to be that derivative instruments are not used from speculative motives, but rather to hedge investment risks. This study seeks to explore if this really is the case. Secondly, this study also attempts to answer the more fundamental question why pension institutions, exceptionally long-term investors, should engage into potentially costly short-term derivative strategies in the first place.

1.2 Research objectives

Objective of this thesis is to comprehensively answer to question: How Finnish pension institutions use derivatives? Aim is to empirically explore further: 1) What derivative instruments Finnish pension institutions use, and what derivative strategies they have utilised? 2) What characteristics differentiate those institutions that use derivatives from those that do not use? 3) What motivates pension institutions to use derivatives, and why some institutions do not use them at all? Finally, the study seeks to describe how answers to these questions are interrelated.

Additionally, on the basis of existing literature this study aims to explore the special characteristics and investment objectives that differentiate pension institutions from other investors, as well as to give a brief overview of the Finnish pension system and regulations. Most importantly, academic and practical arguments why pension institutions should and should not engage into derivative activities are explored and hypotheses for empirical part are developed.

1.3 Research contributions

Due to lack of sufficient data, empirical research on the derivatives usage of the pension institutions is fairly limited internationally. Especially, this thesis is the first comprehensive academic and public study on the derivatives practices of the Finnish pension institutions. Results of the survey questionnaire provide a unique data set of the characteristics and attitudes of the Finnish pension institutions. Study creates a coherent presentation of previously undisclosed derivative activities on aggregate level and analyses the drivers of these activities.

More importantly, motivations, strategies and risks underlying pension sector's derivative activities are generally not very well understood by many practitioners and regulators alike. This study aims to address these issues, and especially provide Finnish pension institution managers information that they can use to evaluate and develop their own derivative policies. Research results are also potentially of public interest due to the large role pension institutions have in the Finnish financial markets, underlined by the inadequate disclosure of the pension sector's derivative activities.

Finally, this thesis utilises new approach based on the marketing research literature to map out motives and limitations of largest players in the derivatives market, and uses quantitative approach to analyse how these qualitative issues relate to their actions in the derivatives markets. Hopefully the methodology employed in this study will give fresh ideas to other researchers in the field of empirical finance.

1.4 Research limitations

Many of the studies on the pension fund management are from the US, and any recent results are hard to be found. As this research concentrates on the Finnish pension system, the results are not

directly comparable to many of these existing studies. The uniqueness of the Finnish regulatory framework and relatively young financial markets further make any direct comparisons with existing international studies inherently difficult. Additionally, the focus of this study, as well as its approach, are new to Finnish pension institution research. Consequently, comparisons with existing domestic studies are equally difficult.

Moreover, problems and limitations of survey research methodology are present in this study. First, survey results are naturally affected by the subjective judgment involved with the questionnaire design. Secondly, responses were not obtained from all institutions and this limits the generalisations that can be made from the results. Thirdly, due to the relatively small population size, survey sample is fairly limited and statistical evidence is not especially robust. Nevertheless, survey was rather well received and response rate is relatively high compared to similar surveys.

1.5 Research structure

The rest of this paper is organised as follows. Sections 2, 3 and 4 create a theoretical framework on the basis of the existing literature for the empirical study in the parts 5 and 6.

Section 2 looks at pension institutions as investors in the financial markets, outlines their importance, gives an overview of pension institutions assets and liabilities, and sums up the academic views on how their investments should be managed.

Section 3 continues to the main issue of this study, and characterises how pension institutions act in the derivatives market. This section introduces a view of the pension institutions as a driver of the financial innovation and takes a brief look at the derivative instruments available. Possible motivations of using derivatives and reasons for not using them are summarised. Finally, section concludes the theoretical discussion on the pension institution literature and analyses the previous international empirical evidence on the pension institutions' derivative activities.

Section 4 gives a closer view on the peculiar characteristics of the Finnish pension institutions for international reader. This sections briefs about the Finnish pension system in general, defines types of pension institutions and takes a look at their asset allocation. The impact of the unique Finnish regulations on the pension sector's investment activities is also examined.

Section 5 introduces the survey methodology used in this study. Section defines the population of this study, introduces the questionnaire used, develops the hypotheses for the empirical tests, and describes the statistical methodology used to analyse the responses. Section 6 analyses the results and discusses of their robustness and other factors limiting the conclusions of this study. Section 7 concludes and provides ideas for the future research.

2 Overview of the pension institution literature

Pension institutions are a truly exceptional class of investors in many countries; they are large investors, have statutory mission and investment objectives and their investment policies are constrained by multiple regulations and regulators. This section first defines the focus group of this study, and then outlines its importance and special nature of its business.

2.1 What is a pension institution?

This study defines pension institutions as companies, foundations or funds that manage investments for the pension system, i.e. collect contributions to provide pensions either now or in the future. This is important difference to other institutions in the sector, such as regulators and other government bodies that are mainly concerned about how the system is organised. While the task to secure pension benefits is rather universal for all pension fund managers, there are considerable cross-country differences in how pension systems been organised as Clark (2000) points out.

Firstly, Clark (2000) notes that the relationships between social security, sponsored pension and retirement plans, and individual retirement accounts are essential to any understanding of pension systems. Secondly, the systems can be characterised on whether they finance current benefits (pay-as-you go, PAYG) or manage funds for future payments (prefunding). Thirdly, prefunded systems can be further classified whether they have promised fixed payment in the future, or a payment depending on investment performance. Next these classifications are analysed in more detail.

2.1.1 Categorisations of the pension systems

Categorisation of the pension systems starts with making the difference between social security, sponsored pension schemes and individual retirement accounts. These three ways to finance pensions benefits are noted as three pillars of the pension system. In the first pillar, i.e. social security, governments usually carry the ultimate responsibility for social security pensions. Usually these systems are also funded according the pay-as-you-go, where the current workforce pays contributions to finance current pensions (Gruber, Wise 1997). Many western European countries operate this way for historical reasons, and pension institutions do not form that significant investor segment. However, as Clark (2001) points out, for these countries looming demographic crisis, i.e. ageing of the baby boomers generation, has put pressure to shift the financial burden towards other pillars of the pension security and towards more investment oriented culture. As this study discusses in the third section, this is evident also in Finland where pension liabilities are increasingly prefunded and sponsored.

Second Pillar, sponsored system, has traditionally been very important to Anglo-American economies (Clark 1997). In this pillar the plan sponsor, usually employer, contributes certain proportion of the paid salaries towards the pension benefits. Usually these plans are also fully or partially funded meaning that the plan trustee invests the contributions that are paid out in future as the employee retires (Clark 1997). Unfortunately enough, systems based on this pillar have had even harder times over the last years. High allocation to equity markets in the period of dismal market performance has caused many of plans to fall short of their return targets. As a result, resulting higher contributions are threatening the solvency of American corporations, cities and federal government (Ryan, Fabozzi 2003).

In the US, these trends have led to initiative to reform the whole pension system. Current (Bush's 2nd) administration is planning to build a new pension system on the 3rd pillar, i.e. on the individual private accounts (Economist 2005:1). This indeed would be a dramatic change towards "a nation of investors", and would outline pension sectors importance for financial markets even further. (Feldstein 1998)

2.1.2 Defined contribution vs. defined benefit pension plans

Perhaps the most important distinction between pension institutions for this study is the nature of their liabilities. An institution that collects contributions for future benefits, can either promise a fixed payment to the policyholder, i.e. defined benefit or DB plan, or just promise a payment contingent upon contribution level and investment yield, i.e. defined contribution or DC plan.

Bodie (1988) demonstrates that pension institution's investment policy depends critically on this distinction. Intuitively, for defined contribution plans investment policy is not much different from any individual deciding how to invest money. The guiding principle is efficient diversification, that is achieving the maximum expected return for a given level of exposure, similarly to Markowitz's (1952) famous model. As a contrast, in the defined benefit plan the future pension benefit is determined by a formula that takes into account years of service with the employer and accumulated earnings.

Defined benefit plans are also much more interesting from research's perspective. First of all, DB plans have been the dominant form of pension financing across countries (Clark 2000), also in Finland, and is thus worth focusing on. Secondly, in funds managing DB plans, formulating and implementing fund's investment policy becomes less straightforward exercise; fund's liabilities need to be taken into account. Indeed, pension fund management has been evolving from an asset-only framework to one that focuses on the impact of the asset-liability relationship (Peskin 1997). While asset allocation in the mean-variance framwork has been well researched since Markowitx (1952) early work, there are considerably more work to be done in understanding the way liabilities affect asset allocation policies. Finally, Papke (1991) notes that in the U.S. policy makers are more interested in the investment policy of the defined benefit plans, since they are insured by a government agency, the pension benefit guarantee corporation (PBGC). Similar guarantees are in use in various countries, including Finland.

Next subsection takes a closer look at these assets and liabilities of defined-benefit plans, and underlines how they are different from many other institutional investors.

2.2 How pension institutions are different from other institutional investors?

2.2.1 Importance of pension institutions in the financial markets

On the asset side, pension institutions are rather like any other institutional investor. They have a set of investment assets that yield a return, and they have to make decisions how to manage these assets. However, there are some important differences that outline their difference from other institutional investors, and their importance to financial markets.

First of all, typically pension institutions diversify their holdings to multiple asset classes that can be quite different from each other. As contrast to equity fund manager that may be limited to, say US equities, pension plans may invest into cash instruments, domestic and foreign fixed income, global equities, private equity, real estate, commodities and many others (Papke 1991). Pension institutions can also employ external fund managers that are to invest into plain mutual funds or hedge funds. Consequently, pension institutions are active investors in many areas of capitalist economy. Additionally from academic point of view, as Blake et al. (1998) note, little is known about the properties and the investment performance of the multiple asset class portfolios. Pension institutions' asset allocation can be a complex process, even if we ignore how the liability side affect the investment policy.

Secondly, pension institutions tend to be largest investors in any country, and have overwhelming impact in the markets they operate in. For example, in a recent study on the US pension fund investing in the 90s, Healey and Rozenov (2004) show some staggering conclusions. Assets under control of the 200 largest pension investors in the US, had more than doubled in the 90s and now account some 35% of the US gross domestic product and 11.5% of the total capital market. Here in Finland, pension institutions had assets under management around 85 billion euros in 2003, amounting to 58% of the gross domestic product. (Ilmakungas, Vanne 2004). Understanding the behaviour of the pension institutions is thus paramount to understanding Finnish capital markets.

Clark (1997) offers an interesting qualitative analysis on the importance of the pension institutions in the modern international capitalism. He concludes that over the last decades pension funds have become very important financial institutions in Anglo-American economies; besides financial markets, they are increasingly powerful voice in corporate governance and

domestic policy. He notes that even if pension institutions are not that dominant force in continental Europe due to the popularity of pay-as-you-go schemes, the trend is towards increased prefunding.

Pension institutions are thus important players in the developed financial markets, and their participation in the derivatives market is of public and academic interest. To provide background on the pension institutions derivatives activities, this literature overview next summarises how pension liabilities influence institutions activities.

2.2.2 Pension liabilities affect institutions investment choices

It is critical to fully understand the nature of pension institutions liabilities to understand their investment policies, asset allocation and derivative activities. In a defined benefit fund, the future pension payments guaranteed to employees are a pension institutions' liability. Simply put, the present value of these liabilities is defined as the current pension liability. In practise however, future pension payouts are determined by complex formula, and liability measurement is both art and science, involving actuarial methods, financial economics as well as country specific regulations (Ryan, Fabozzi 2002).

Asset side of the pension institution's balance sheet is then indented to cover these pension liabilities, and through successful investment activities to contribute towards pension funding in the future. More specifically, pension institutions assets equal to an accumulation of contributions plus investment earnings less benefits payments. (Bodie et al 1999)

Following discussion summarises existing academic views on the pension liabilities:

Stux (1995) introduces five ways to define pension liability:

1) Vested benefit obligation (VBO). Present value of the pension benefits that have been earned and vested in the employees. VBO remains the same whether or not the employees continue working with the company. Smallest measure of a pension liability.

2) Accrued benefit obligation (ABO). Present value of the benefits that have been earned to date by employees, whether vested or not. ABO assumes that employees continue working with the company. Usual used by the regulators.

3) Present benefit obligation (PBO) is same as ABO, but it is also adjusted for the estimated salary level increases. The estimated salary level is the basis at which the actual benefit will be calculated. Hence Stux (1995) argues that PBO seems to be the most realistic view of the pension liabilities.

4) Future benefit obligation (FBO) is the PBO and the present value of all the future PBO estimates. These include all the additional benefits that present workforce are likely to accumulate. FBO also includes additional benefits accrued due to the accumulated years of service in the same firm.

5) Strategic benefit obligation (SBO) is the largest measure of pension liability. It is PBO plus the effect of change in workforce in the future. Stux (1995) notes that it is an informative tool especially in growing companies with growing personnel.

Black (1989) illustrates this same idea with a narrow and broad view on the pension institution's liabilities. Narrow pension liability would the liability that the plan sponsor would have if all employees would quit and they were not replaced. Broad view would be what the claim to all benefits paid by the institution would sell for on open market today, i.e. benefits paid to current, past and future employees.

Blake (1998) goes a step further to define pension liabilities as options on pension institutions' assets, and the value of these options depends on both contribution inflows and asset allocation chosen.

Additionally, Bodie (1988) argued that pension liabilities could be viewed as an integral part of sponsor's liabilities. Especially, in the corporate setting if pension funds' surpluses or deficit would belong to the company's shareholders, and pension fund investment decision would be an integral part of the corporate financial policies.

Finally, whatever the view on the pension liabilities may be, the actual valuation of these liabilities is governed by country-specific regulations (Clark 2001). Normally, the logic is rather universal. First, the future pension payout are estimated with actuarial methods, i.e. for example by utilising information on the life expectancies, salaries, and years of employment. Then the present value of these payouts is calculated as the current pension liability. In the US, valuation

convention is governed by the Financial Standards Accounting Board (FASB). FASB is quite clear how the pension liabilities are to be priced: Each liability is required to be priced as a high quality zero coupon bond whose par value matches the liability payment amount, and whose maturity matches the liability payment date (Ryan, Fabozzi 2002). IFRS standards (IAS 26) apply same logic as FASB. In Finland current regulation requires the use of administrative flat discount rate.

Consequently, pension liabilities behave like a long duration bond, and their value is extremely interest rate sensitive. This is especially true for pension plans that manage funds for relatively young employees. However, as Black (1989) points out, interest rate risk is not the only factor affecting the value of the liabilities. If the pension liability is defined in the broad sense to account for benefits paid to past, current and future employees, various other factors enter the equations. Black notes rather cynically that in this case whatever we can forecast affects the value of the liabilities.

As a conclusion, pension institution managers need to consider both assets and liabilities. Pension liabilities are an important factor affecting pension institutions investment policies, and hence their derivatives strategies. Academic discussion on the optimal investment policies and asset allocation for pension institutions is summarised in the following section.

2.3 Pension institution investment policies

2.3.1 Objectives of the pension institution management

Even with the emergence of the coherent asset-liability framework in practical and academic literature, Ryan and Fabozzi (2002) argue that many pension asset managers ignore their liability-structures when setting their investment policies. Of course this is rather hard to examine empirically. However, this reflects the first and simple view on the pension institutions objectives: deliver highest return on assets for a given level of risk. Ryan and Fabozzi (2002) argue that since measuring the pension liability is not a straightforward exercise, but involves actuarial and accounting smoothing, pension institution managers have an incentive to ignore the liability side in their considerations.

In the academic literature the focus has long ago shifted to finding optimal match between pension institution's assets and liabilities. Bodie (1988) reviews existing literature on the pension fund investment policies at the time, and concludes that the majority of the literature seems to advocate immunization strategies to hedge benefits owed to retired employees. This strategy is an extension of the second view on the pension institution's objectives: to meet the future pension liabilities of the institution.

Third view is that pension institution's objective should be the minimisation of the sponsor's contribution rate. Haugen (1989) studies the pension fund management in the context of the corporate risk management and concludes that the risk of increased contributions from the sponsoring corporation has to be included in the plan management objectives. Ito (1995) argues further that the pension fund sponsor should have a secondary objective to achieve an earnings spread. This positive gap between assets and liabilities can reduce future contributions.

Interestingly enough, in a later article Bodie (1990b) concludes that these objectives are contingent upon the funding status of the pension plan. He finds that incentive to immunize is the greatest when the plan is fully funded. On the other if the plan is very underfunded, plan sponsor may have an incentive to employ risky strategies and exploit the government guarantee on the defined benefit plans.

Obviously, these three views are not mutually exclusive. Ryan and Fabozzi (2002) incorporate these views to state the objective of the pension fund management is "to fully fund accrued pension liabilities at the lowest possible cost to the plan sponsor, subject to sensible risk".

To sum up, academic literature suggests that successful investment policy of a pension institution stems from the structure of its liabilities, aims for best investment returns to minimise contributions needed, but takes only sensible risks.

2.3.2 Risks in the pension institution management

Pension institution faces a risk that derives from the relationship between the uncertain investment returns on its assets and uncertain growth rates of its liabilities. If the institution fails to meet its investment targets, and the present value of its liabilities grows faster that its assets, by definition extra contributions will need to take up the slack, or institution's funding status

deteriorates. Mismatch between pension institution's assets and liabilities is thus key risk in pension institution management.

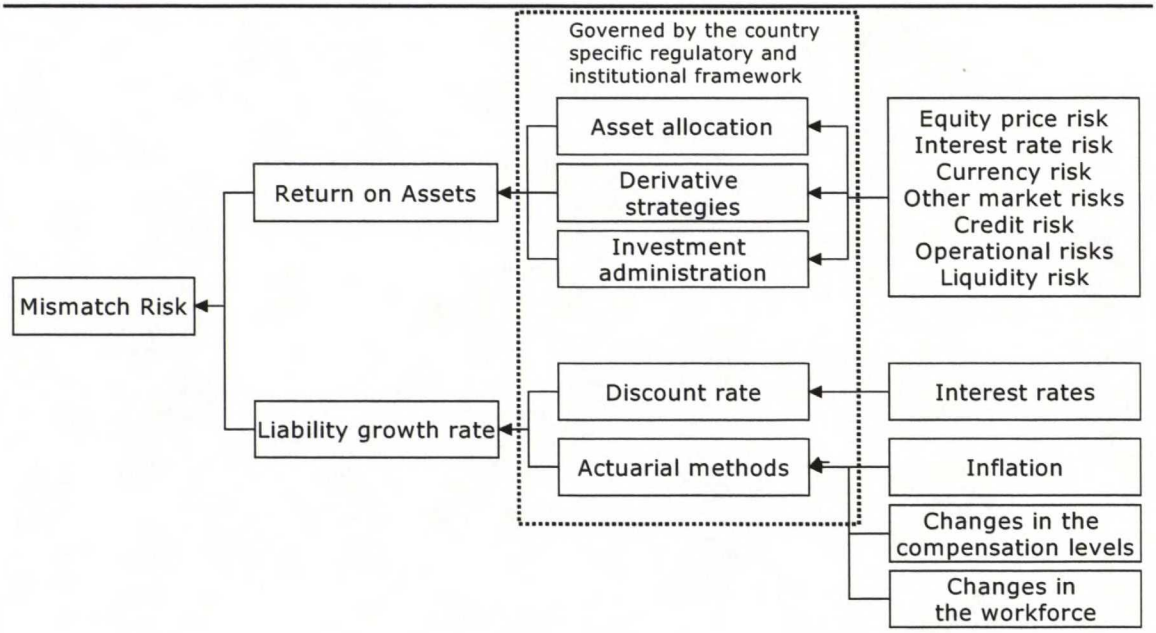
Ponds and Quix (2003) define this "mismatch risk" more specifically as the standard deviation of the institution's excess return, i.e. the difference between the return on assets and the return on liabilities. The higher this excess return, the less contributions are needed in the future since larger part of the pension liabilities can be covered from the investment income. Ponds and Quix note that higher excess return can only be achieved through higher mismatch risk, i.e. having assets that do not perfectly mimic the growth of the institution's liabilities.

Leibowitz et al (1994) advocate similar approach, and argue further that instead of measuring traditional return on assets, pension institution should focus more their funding ratio return (FRR). Leibowitz et all (1994) define FRR as the percentage change of the institutions funding ratio over one-year investment horizon. This target would integrate mismatch risk into traditional asset allocation process.

Pension institution's mismatch risk stems from various risks in its assets and liabilities. Figure 2.1 presents the factors driving the mismatch risk, and summarises the analysis on the pension institution's assets and liabilities.

Figure 2.1 - Mismatch risk and its drivers

This figure describes the mismatch risk, i.e. the difference between return on assets and the growth rate of pension liabilities, in pension institution management. Various sources of market and operational risks and their management results in the return on investment assets for given period. On the other side, liabilities are mainly driven by actuarial methods used to calculate pension liabilities and the interest rate environment. Country specific regulatory and institutional framework significantly impacts the way these two sides of the balance sheet interact.



Mismatch risk can also be divided into long-run and short-run components. Ponds and Quix (2003) put forward that this mismatch risk is in the long-run lower than in the short-run. They argue that this is due 1) average equity risk on annual basis decreases as the investment horizon is increased, and 2) in the long-run a more positive correlation can be observed between pension institutions assets and liabilities. As the pension institution should in theory have an infinite investment horizon, it should be in excellent position to benefit from a decline in investment risk over time.

These long-run benefits in risk reduction over time stimulate pension institutions to aim for long-term objectives in their investment policies. However, Ponds and Quix argue that risk management in the short-term also remains important. These short-term risk management considerations provide a profound reason for the pension institutions to engage into derivatives activities, and will be explored further in the third section of this study.

Next subsection takes a closer look at the long-term issues in pension institutions investment policies, defines these as an asset-liability management framework and analyses how that affects pension institution's asset allocation choices.

2.3.3 Asset-liability management and asset allocation choices

Asset-liability management (ALM) provides a framework for assessing and managing these risk exposures systematically and efficiently. Society of Actuaries (SOA 2003) provides a useful definition:

> "ALM is the practise of managing a business so that decisions and actions taken with respect to assets and liabilities are coordinated. ALM can be defined as an ongoing process of formulating, implementing, monitoring and revising strategies related to assets and liabilities to achieve organisations financial objectives, given the organisations risk tolerances and other constraints. ALM is relevant to, and critical for, sound management of the finances of any organisation that invests to meet its future cash flow needs and capital requirements." (SOA 2003)

Most obviously, ALM should be the cornerstone of the investment policy of any pension institution. It fits well together with academic view on the pension institutions objectives, and gives practical framework to institutions' managers. Peskin (1997) summarises that the ALM focus "saves money and reduces risk" for pension plan sponsors. Unfortunately, this result does not extend itself very well into concrete investment policies or asset allocation guidelines. SOA (2003) notes that ALM in pension institutions is further complicated by having one pool of assets and several liabilities, which are defined by the various regulations and administrative organizations.

Popular ALM-method in practise, and much advocated in the academic literature is to immunize the pension obligation by allocating pension institution's assets to fixed income portfolio that moves in tandem with the pension liabilities. Peskin (1997) demonstrates how the key way to do this is to extend the dollar duration of the fixed income portfolio to match the duration of the pension liabilities.

Steward (2003) outlines the key benefits of investing into diversified long-duration portfolio. First, it is cheaper to operate than equity portfolio since its management fees and transaction costs are considerably lower. Secondly, he reminds that the fixed income portfolio has more predictable earnings, and hence stabilises the contributions needed. Most importantly, he argues that fixed income portfolio is more easily matched with the pension liabilities and consequently leaves little room for equity allocation in pension institutions.

Bodie (1988) argues that this immunization strategy works well for hedging benefits to already retired employees, because the benefits are nominal and duration match is easily obtained. However, if the institution takes a broader view on the pension liabilities and takes into account future and future employees, it apparently makes sense to invest into more risky assets as well.

Additionally, Ponds and Quix (2003) argue that pension institutions with a heavy fixed income investment are very vulnerable for a switch from low inflation to high inflation environment. Since in many countries the future pension contributions are indexed to inflation, higher inflation will cause the value of pension institution liabilities go up. Unfortunately, higher inflation also means higher nominal yields and lower bond prices. Thus there is a profound reason for pension institution to invest into equities as well.

Black (1989) elaborates these arguments. He demonstrates how a pension institution might be better of by investing into equities as well using two simple scenarios. First, imagine that the economy does well over the next 20 years. Business prospers and the pension plan sponsor sweetens the benefits to employees and hires new workforce. In this case, the pension liability will increase faster. Secondly, if the economy does poorly, plan sponsor is more likely to hold back the benefits and hiring. Pension liability is likely to be lower. Black (1989) concludes that broad pension liabilities behave rather like the stock market, and that pension institution should allocate part of their investment portfolio into stock market. Exact allocation will depend on the institution's liability structure.

Peskin (1997) elaborates on these arguments and takes the view that optimal equity allocation is institution specific. He identifies five factors that drive the equity allocation: "noise in liabilities", "weight" attached to surplus value, funded status of the plan, growth in the workforce and term structure of the sponsor's borrowing cost. Of these factors, "noise" in liabilities and

growth in the workforce are similar arguments laid out by the Black (1989). If the future liabilities are not well know today due to uncertain wage developments and workforce growth, equities can be used as a hedge to pension liability. Interesting is also his notion that in general poorly funded plans have an incentive to invest into riskier assets due to government guarantee. In this case, all upside is valuable since the sponsor can exercise the put option to the government. In very well funded plans, the funding status provides a cushion against downside risk making equity investments an attractive payoff. Peskin (1997) also notes that flexible rebalancing of the portfolio due to changes in these five factors or conditions in the capital market can be a significant source of savings for the pension institution sponsor.

Key issue in the pension institution asset allocation seems to stem from the liability side. A long-duration bond portfolio can relatively easily hedge benefits to retired employee, but hedging liabilities to active and future employees involves further complexities. Ryan and Fabozzi (2002) propose more proactive asset allocation strategies to tackle this problem. In addition to traditional fixed income instruments, they think that more dynamic asset classes are needed such as equity, structured notes, alternative investments and unconventional assets (e.g. timber, real estate).

Bodie (1988) recommended portfolio insurance strategies to hedge these broad liabilities (or the PBO, Present Benefit Obligation). He defines these as strategies that have a zero probability of getting returns below the actuarial discount rate (used to discount the liabilities), but a positive probability of obtaining return above this rate. He proposes three methods to do this: buy stocks and protective puts, buy T-bills and call options on stocks, or pursue dynamic hedging strategy with stocks and T-bills. However, in a later article (Bodie 1990) he argues that PBO is not suitable target for pension institutions' investment policy, since only the narrower definition (the ABO, accumulated benefit obligation) correctly reflect actually promised benefits, and hence the economic reality.

All in all, after having advocated diversification and riskier investments, recent articles clearly reflect the dismal equity market performance in the early 2000. Steward (2003) advocates heavily safe fixed income investments and Ryan and Fabozzi (2003) identify equity allocation as the main reason of the current "pension crisis". Merton (2004) draws the attention to risk

imposed to sponsor's shareholders by the mismatch of holding equity-like assets in the pension fund, and having debt-like pension liabilities. He empirically concludes that sponsor's market value reflects this additional risk.

As a conclusions, while theoretical pension institution literature largely agrees that the ALM-framework is an integral part of sound pensions management, a considerable controversy remains on 1) scope of the pension liabilities to be hedged (narrow vs. broad view) and 2) what kind of asset allocation pension institutions should pursue. Key question for this study is that if pension institution does not able or willing to fully immunise its balance sheet, how should it deal with the short-term financial risks that inevitable arise? Additionally, should pension institution alternative "non-traditional" assets and strategies, such as derivatives, to enhance returns to its asset portfolio to achieve excess returns?

To get an overview how pension institutions invest in practice, next subsection summarises empirical evidence on the pension institutions' investment policies.

2.4 Previous empirical evidence on pension institutions' investment policies

Surveys on the pension institutions' asset allocation have mainly been conducted in the US market. Papke (1991) presents a comprehensive survey based on the by the US private pension funds as reported to the Inland Revenue Service. He finds that pension funds indeed allocate more of their assets to fixed income. He reports that average funds hold about 50 percent in fixed-income, 20 percent in equities and 20 percent in pooled funds. Only 20 percent of the funds hold more than 60 percent in equities.

Healey and Rozenov (2004) study the 200 largest defined-benefit pension funds, and find that equity allocation increased its share from around 48 percent to around 57 percent. They also find that these plans were increasingly allocating funds to alternative investments (such as private equity and hedge funds), real estate and enhanced indexed equities and bonds. They forecast that the significant change in the future would be even more towards new non-correlated asset classes such as private equity, hedge funds, timber and energy. This is due to their defensive properties in the low return and high volatility environment.

Blake et al (1998) report their findings on the asset allocation and performance of the UK pension funds. They find that the allocation of the UK pension plans have remained rather steady from 1986 to 1994. Notable is the high allocation to equity market at around 78%, with only 14 percent in the fixed income. This may be due to structural differences between the US and UK, notable absence of investment constraints in the UK and overfunded status of many UK funds. However, Blake et al (1998) focus on the investment performance not on asset allocation.

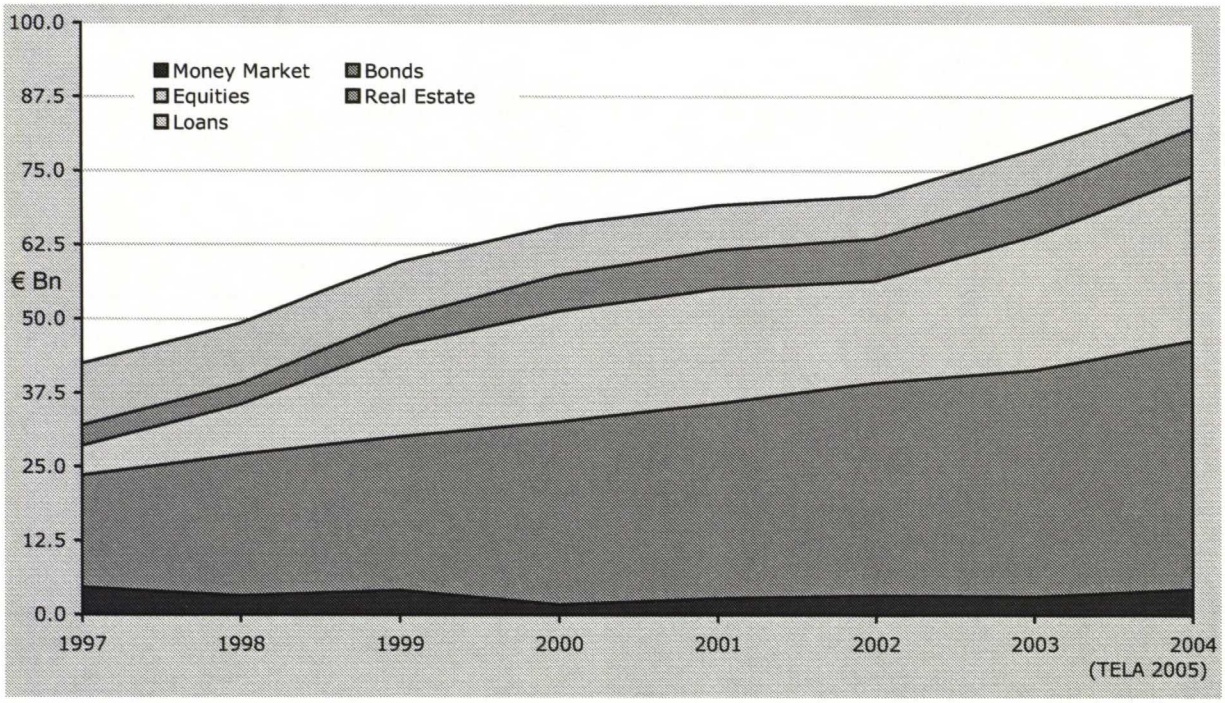
Apparently, coincidence of the increased equity allocations in the US and the equity market downturn has spurred an increase in the asset-liability studies in the US pension sector. Feinberg (2002) has interviewed many pension fund managers and concludes that deteriorated funding status has led to appraisal of the asset-liability matching.

Unfortunately, these few empirical studies on the pension institution asset allocation and investment policies do not reveal much. However, significant amount of equity allocation both in the US and UK does hint that pension institution managers tend to take a broader view on the pension liabilities, and do pursue other strategies than plain fixed income immunisation.

In Finland, despite pension sector's large impact relatively little empirical research has been conducted. Fortunately, the aggregate data for the pension institutions' asset allocation is easy to obtain. Finnish pension alliance, in co-operation with the Finnish Insurance Supervisory Authority and the Bank of Finland compiles comprehensive data on the investments of the Finnish pension institutions. Figure 2.2 describes the asset allocation of the Finnish pension institutions.

Figure 2.2 - Trends in the asset allocation of Finnish pension institutions

This figure describes the developments in the asset allocation of Finnish pension institutions since 1997. These statistics is compiled annually by the Finnish Pension Alliance, in co-operation with Finnish Insurance Supervisoy Authority and the Bank of Finland.



The share of fixed income investments was over 50 percent, and the share of equities was only 31 percent in 2004. However, since the solvency margin requirements for Finnish pension providers were revised in 1997, the share of stock has steadily risen from 12 percent. Additionally, Ilmakungas and Vanne (2004) demonstrate that the share of foreign investments has risen steadily since the early 1990's when there almost no foreign investments in the Finnish pension institution's portfolios. Apparently, these developments suggest that the investment policies of the Finnish pension institutions are to some extent driven by the Finnish pension institution regulation, instead of their liability structure. This Finnish institutional and regulatory context is analysed into more detail in the fourth section of this study.

However, Alestalo and Puttonen (2004) demonstrate that Finnish pension funds take their liability structure into account in their investment policies. With a data set of 44 Finnish pension funds, they empirically study the relationship between the pension funds' liability structures and their asset allocation. They find that pension funds with younger participants indeed have more equity exposure, and that more mature pension funds have more fixed income investments.

As a conclusion, pension institution literature implies that the rationale for pension institutions to use derivatives fundamentally stems from the mismatch risk between their assets and liabilities. Pension institutions, both internationally and in Finland, have large and increasingly diversified portfolios, but it is next to impossible to match assets and liabilities exactly. This means that 1) the short-term risks in their asset allocation such as equity, interest rate and foreign exchange risk and 2) the need to achieve acceptable investment returns to their assets in all investment environments drive the demand on derivative instruments. Also the regulations have large impact on the investment strategies of pension institutions.

Next section describes derivatives market into more detail, and outlines the motivations for using derivatives as well as reasons not to use them.

3 Pension Institutions in the Derivatives Market

In chemistry, a derivative can be characterised as a substance made from another substance. Derivatives in financial markets work on the same principle. In his famous and comprehensive book on derivative securities, Hull (2000) defines: "A derivative (or derivative security) is a financial instrument whose value depends on the values of other, more basic underlying variables." Stulz (2004) notes further that the underlying of a derivative is often a financial asset or rate, but it needs not to be. For example, derivatives may exist on the level of Helsinki Stock Exhange index, as well as on weather in northern Norway.

Unarguably, last years have seen astonishing growth in the derivatives market. International swaps and derivatives association estimates that since 1997, global outstanding notional value of interest rate and currency derivatives alone has exploded from around 29 trillion USD to 165 trillion USD in 2004 (ISDA 2005). Despite adequate public data is not available, increasingly sophisticated and diversified Finnish pension institutions have seen their share of this action as well, without a doubt.

Internationally derivatives have caused losses and made headlines: From the fall of Barings, the bank of English queen, to collapse of the world's largest hedge fund, Long-Term Capital Management, and to accounting scandal of one of the world's most respected company, Enron. Even Warren Buffet called them "weapons of mass destruction" in Berkshire Hathaway 2002

annual report. Once again, why would a Finnish pension institution, a sound long-term investor engage into such activities?

As Stulz (2004) points out, for the society as whole there are various risks involved in institutions' derivative activities, but on balance their benefits should outweigh these threats. But is the same true for Finnish pension investors? This section of this study overviews and analyses various derivative instruments the Finnish pension institutions may use, and more importantly examines various reasons why they should use them and why not.

3.1 Pension institutions and financial innovation

Pension institutions have been actively involved in the derivatives market in the US. Clair (2000) summarises a derivatives usage study by the Greenwich associates, and interviews various pension fund managers in the US. He concludes that US pension investors attraction to derivatives instruments has been growing as institution's managers become more familiar with them to cut trading costs, enhance revenues and protect against volatility.

Academically, pension institutions can even be viewed as one of the main drivers of the dramatic growth of the derivatives market. This view was presented by Bodie (1990) when the derivatives market was still in its infancy. He argues that the special nature of the liabilities of defined benefit pension funds, i.e. their guaranteed future payouts, and the investment strategies they employ to hedge these liabilities, i.e. ALM-approach introduced in previous section, drives financial innovation and demand for new derivatives structures. He further notes that implementation of, for example, immunisation strategies is feasible without derivatives, but the existence of liquid derivatives market may make these strategies "less costly and less disruptive" for pension institutions' managers.

In a more recent paper, Capelleveen et al (2003) go a step further to argue that derivatives can even help to solve the looming pension fund crisis in the developed world. Using a scenario-based ALM-model, they demonstrate how including options to pension institution's portfolio can add substantial value to pension fund management. They think that this because pension institutions have a preference for non-linear payoffs. Intuitively because small change in the

probability of extremely high future pension liabilities is more of concern than extremely high future refunds.

Additionally, Miller (1986) points out that regulations and taxes drive many financial innovations. Due to their critical importance for the society, pension institutions are heavily regulated and this should create demand for derivative structures. This is especially true in Finland where there are various rules for pension institution's investment activities, as it will be demonstrated in the fourth section of this study.

Apparently, there exists rationale for pension institutions to use derivatives. Before analysing these rationales into more detail, next subsection gives a brief overview on the derivative instruments available for Finnish pension institutions

3.2 Overview of derivative instruments available

Often the mere term "derivative" is not particularly useful since it is not always easy to define. Additionally, for the purposes of this study, it is more useful just to categorize derivatives to various classes and explore why do they exist. Next subsection presents the most common derivative classes.

3.2.1 Forwards and futures

A forward or future is a particularly simple derivative. It is an agreement to buy or sell an asset in the future for a certain price, agreed today. A forward contract is an agreement between two counterparties and is normally not traded on an exchange. A futures contract is similar to forward but normally exchange traded.

Forwards and futures are used for hedging and speculating. A Finnish pension institution owning German government bonds can hedge its position by selling some futures on the bond. Moreover, since forwards and futures typically do not require any payment up front (excluding initial margin), they provide leverage and can be less expensive means of speculating. Long-term investors such as pension institutions should find speculating less attractive option. Futures and forwards can also provide lower transactions costs and more liquidity in some occasions.

3.2.2 Options

An option is the right to buy (a call option) or a right to sell (a put option) an asset at a certain future time for a certain price, called the strike price. There are two sides to every option contract: the long position who has bought the contract, and the short position who has sold, or "written", the contract. Option to buy or sell in the future is a valuable asset and the buyer of the option thus pays an up-front premium for this right to option seller. A long position in option is essentially a leveraged position in the underlying asset with a limited downside, and a short position receives cash up-front but has potential liability later.

Partnoy (1997) argues that a principal justification for options is to create customized payoffs and returns to meet specific needs. It is possible to create almost any payoff pattern with an appropriate set of options. As noted in the previous subsection, Capelleveen et al (2003) argue that this very non-linear payoff pattern should make options attractive to pension institutions.

3.2.3 Swaps

A swap is an agreement between two parties to exchange cash flows at certain times according to a prearranged formula. Hull (2000) notes that where as forwards leads to exchange cash flows at a certain date in the future, swaps typically lead to exchanges on several future dates. Swaps can be customized to convert any cash flows; they can be based on interest rates, interest rates in different currencies, stock market return, commodity prices and many others.

The most simple type of swap is a "plain vanilla" interest rate swap. In this, institution A agrees to pay institution B fixed, a predetermined rate on notional amount for a number of periods, and institution B agrees to pay a floating rate for the same principal and periods. In this simple form, swaps can be used to transform pension institutions assets and liabilities from fixed rate to floating rate and vice versa.

Bodie and Merton (2002) note that traditionally pension institution have hardly used swaps in their portfolio management. Nevertheless, they argue that time has come to change this. They outline various reasons for pension institutions to use swaps, such as hedging and international diversification and lower transaction costs.

3.2.4 Structured notes and repackaging vehicles

Structured notes have emerged as important, and sometimes notorious, instruments in financial markets. Das (2001) defines structured note as a "security that combines the features of a fixed income instrument with the characteristics of a derivative transaction (in effect, the return profile of a forward or option on a selected asset class)".

Repackaged structured notes are a special class of structured notes. Das (2001) defines these as "structured notes created by using special purpose issuance vehicle or asset repackaging structure to repackage risk of securities ". This means that a special purpose entity is formed that buys securities from the secondary market and then reprofiles the cash flows of the underlying securities by entering into securities transactions. Das (2001) argues that use of repackaging vehicles gives greater flexibility to structure the investments to fit the needs of the issuer and the investor.

Simply put, structured notes are a package of plain fixed income security and mixture of forwards and/or options. For example, a bond that has a coupon contingent on the stock market performance is a structured note; in its simplest form a combination of stock index future and a zero-coupon bond. So why would someone pay a premium to buy these components in one package?

Unarguably, the main reason is investor expertise. A Finnish pension institution may find it easier and more convenient to buy a capital guaranteed note denominated in euros with its coupon linked to Japanese stock index, than a zero coupon bond and a large portfolio of call options on Japanese stocks denominated in yen. Das (2001) also notes that one main reason for the popularity of the structured notes have been their suitability for regulatory arbitrage, or in other words, to circumvent barriers to trading in the relevant derivatives directly.

In addition to their attractive features, use of structured notes pose new risks to pension institutions that have to be accounted for. Many smaller Finnish pension institutions may not have the expertise needed for assessing the market risk and the fair value of the structured notes.

3.2.5 Exotic derivatives

There exist a vast array of different exotic forwards, options, swaps and other derivatives. For example, Hull (2000) defines as exotic options "derivatives with more complicated payoffs than the standard calls and puts". Not surprisingly, main use of exotic derivatives is speculation as Partnoy (1997) points out. Similarly to structured notes, exotic derivatives allow institutions to take highly customised and leveraged views on the specific market. As long-term investors, pension institutions should have little incentive for the customized short-term speculation that exotic derivatives enable.

3.2.6 Practical considerations

Compared to other financial assets, incorporating derivatives strategies into pension institution's investment policies involves many risks and other practical complexities that need to be considered.

First of all, most of the traded derivatives are over-the-counter (OTC) derivatives. As a contrast to exchange traded derivatives, OTC derivatives are bilateral contracts between buyer and seller, and the market is more loosely regulated. Among other things, this means that OTC derivatives may not have a standard legal form and their price quotations may not be readily available. Pension institution wishing to engage into OTC derivative activities thus need to have necessary financial and legal expertise to enter the derivatives market.

Secondly, engaging into derivative activities involves risks that need to be managed. Main supervisory body of the Finnish pension institutions, Finnish Insurance Supervisory Authority (ISA) has outlined the risks that institutions need to manage. (Vakuutusvalvonta 2003a and 2003b). These include:

- Credit risk – institution's counterparty is unable to meet the obligations of the derivative contract. Only OTC-derivatives involve credit risks.
- Market risk – risk that the market value of the derivative contract changes the value or the volatility of the underlying asset changes.
- Financing risk – risk that pension institution is unable to meet the cash flow obligations of the derivative contract.

- Liquidity risk – risk that the institution is not able to liquidate its derivative contracts at fair values when needed.
- Operational risks – risks that stem from inadequate internal processes, staff expertise, systems or their failures, or from other external factors. Legal risks are also classified as operational risks.

Management of derivative contracts, their risks and regulatory compliance incurs a cost that pension institutions need take into account. Most of these costs, such as hiring and training staff and acquiring adequate computer systems and back-office functions, are rather fixed initial investments that can be quite substantial for smaller institutions. Consequently, use of derivatives has economies of scale that will be explored further in the empirical part of this study.

3.3 Motivations for using derivatives

Academic and practical literature presents various reasons why a pension institution might use derivatives as part of its investment portfolio. Also the regulators have recognised that derivative strategies may add value to pension institution management. For example, Finnish Insurance supervisory authority states that derivatives may be used for hedging, yield enhancement, arbitrage, re-engineering portfolio risk, and overall improve asset and liquidity management. This subsection summarises the arguments presented in the literature.

3.3.1 Short-term risk reduction

As demonstrated earlier in this study, management of the asset-liability mismatch risk is essential in pension institution management. In the long-run, this risk can be managed best using ALM-approach, i.e. taking institutions liability structure into careful consideration in the asset allocation process. Unfortunately, in the short run pension institution's assets and liabilities may deviate quite substantially without careful risk management considerations.

For example, to hedge inflation risks pension institution may allocate substantial part of their portfolio into equity markets. In the long-run, equities have substantially higher expected return than for example government bonds, but equivalently their annual volatility is higher. In other words, even though pension institution may expect to earn, say, 8% pa. on average, for its equity

portfolio, one year this return may be substantially less and destroy the investment performance of the whole institution leading to deteriorating funding status. The key issue is whether long-term investors, such as pension institutions, should manage and hedge these short-term risks? After all, in the long-run good years are expected to make up the bad.

Academic literature seems to suggest that these short-run risks should be managed. First, Ponds and Quix (2003) argue that a pension institution with severely deteriorated funding status due short-term investment performance may no longer be attractive for workers. Workers should know in advance that the funding gap needs to be solved by higher contributions in the future hurting their lifetime income. In Finland, this funding gap would be solved by higher contributions from the employer. However, as demonstrated in fourth section of this study, the competitive nature of the Finnish private pension sector should support similar arguments. Especially for pension insurance companies, bad investment performance in a given year is a reputation risk. Why would some employer choose to arrange pension insurance for its employees from a company that has worse performance than its peers?

Secondly, pension institutions, especially Finnish corporate pension funds, can be viewed as a part of the corporate wide financial risk management. After all, bad investment returns ultimately lead to higher contributions from the employer. These higher contributions inevitably translate into lower financial performance of the company. Arnott and Bernstein (1988) argue that the short-term stability of the pension fund surplus is important for this very reason, its impact on the current profitability and market value of the sponsoring company. On the other hand, in the long run it is more important to obtain good investment results. Haugen (1989) studies pension fund risk management in the context of corporate risk management, and concludes that pension beneficiaries should significantly enhance their wealth by incorporating pension fund into its sponsor's risk management strategies.

Theoretical corporate risk management literature outlines various reasons why a non-financial firm should use derivatives for financial risk management. These reasons include reducing financial distress cost (Smith and Stulz 1985), "underinvestment problem" or costly external financing (Froot et al 1993), taxes (Smith and Stulz 1985) and costs of managerial risk aversion and other agency costs (Stulz 1984), among others. Additionally, it has been empirically

demonstrated that most large companies do employ derivative strategies to hedge their risks (e.g Nance et al 1993, Mian 1996, Gezcy et al 1997, Bartram et al 2004).

While detailed analysis of the corporate risk management literature is beyond the scope of this study, these reasons should extend to the risk management of pension institutions as well. Especially, Cummings et al (1998) argue that risk management to avoid costs of financial distress are particularly applicable to insurance industry, and hence to pension insurers. Similarly to insurance companies, pension institutions are subject to stringent solvency regulation that includes detailed reporting requirements and site audits. Reputation risk can also be viewed as a cost of financial distress.

These motivations can create an incentive for pension institution to use derivatives to hedge parts of its portfolio against short-term risks. In these cases, transaction costs would advocate the use of derivatives as a hedge. For example, a Finnish pension fund wanting to hedge its US equity portfolio against, say geopolitical risks for next 3 months, may find it more beneficial to trade S&P futures than all the cash in all the underlying stocks. Similarly, pension insurance company may want to hedge their US fixed income portfolio against falling US dollar by using foreign exchange forwards contracts.

Derivatives may also be important instrument in managing the interest rate risk of the pension institution. Gold and Peskin (1988) demonstrate how a pension fund can use futures to match the durations, i.e. interest rate sensitivities, of their assets and liabilities.

Thirdly, Ponds and Quix (2003) argue that a pension institution may always find itself in the situation of discontinuation, such as its termination or mergers and acquisition of the sponsoring companies. In these situations it may be more beneficial to hedge pension fund values using futures than liquidate the whole fund.

Finally, the use of derivatives for hedging purposes is preferred by the regulators over other reasons to use derivatives. For example, in Finland derivatives used for hedging qualify for preferential accounting treatment. Essentially, changes in their values may be slumped together with the underlying instrument.

3.3.2 Asset diversification and capital market imperfections

Due to capital market imperfections, such as transaction costs, liquidity costs, information asymmetries, and even inefficient regulation, derivatives may be beneficial diversification instruments.

First of all, derivatives can be less costly instrument for passive investment strategies. For example, Finnish pension institution seeking exposure to Japanese equities find less costly to buy a structured note described in the section 3.2.4 than picking a diversified portfolio of Japanese equities itself, or than employing specialised mutual fund manager. Additionally, derivatives can mitigate costs associated with specialised investments, such as hedge funds. Cowell (2003) notes that poorly planned an executed hedge fund investment can expose the pension institution to extremely high cost, potentially low liquidity and unknowable fund management. Although due to their low correlation with traditional asset classes, hedge funds may be an attractive investment for pension institutions (Gregoriou 2001), these costs may put off many Finnish pension funds wishing to invest. One solution could be to invest into derivative linked to the performance of multiple hedge funds, such structured fund-linked note.

Secondly, derivatives provide a way to invest into asset classes that would otherwise be inaccessible for the institution. Most notable example must be commodities market where commodity futures and forwards provide simple means to participate in the market. Otherwise it would be hard to imagine a pension fund holding millions of barrels oil, or thousands of tonnes copper in their inventories. Nijman et al (2003) examine whether the investment risk of pension schemes investing into traditional asset classes can be reduced by including commodity derivatives into asset portfolio. They find that commodity derivatives add substantial value to pension institutions facing the inflation risk. They report that including commodities into portfolio can reduce the funding ratio risk of the institution more than 30 percent.

Thirdly, derivatives may also provide liquidity to assets that would otherwise be unattractive. For example, increasingly popular method to gain exposure to corporate debt market is the use of credit derivatives, i.e. derivatives (mostly swaps) linked to corporate bond market. Individual corporate bonds may be relatively illiquid and transaction costs may be high and credit derivatives linked to certain underlying corporations may be less costly method to invest. Credit

derivatives can also provide pension institutions method to invest into bank's corporate loans that are otherwise inaccessible. Additionally, credit derivatives can be linked to corporate debt index providing passive method to invest into these assets.

3.3.3 Yield enhancement and other speculative motives

As long-term investors, pension institutions are not expected to speculate on the short-term market movements. Nevertheless, the nature and properties of derivative securities, such as flexibility and leverage, makes them very suitable to use for speculative motives. Unfortunately, these arguments are not well covered in the academic literature, and are hard to examine empirically.

To start with, there may exist a thin conceptual line between derivatives contract for hedging purposes and from speculative motives. A currency forward contract may be viewed as a hedge against dollar depreciation, but at the same time as an expression of a market view that dollar does not appreciate. Other contracts, such as exotic derivatives, may be intended as hedges, but for outsider's eye may look like leveraged bets on the market.

Leaving conceptual controversies aside, derivatives can certainly be used in an attempt to enhance pension institution's investment performance. Derivatives, especially OTC-derivatives such as swaps and structured notes, can be used to take market views that would not otherwise be available and thus diversify institution's investment portfolio. For example, a pension institution wishing to benefit from certain interest rate differentials may not have the expertise to structure a trade benefiting from this view. In this case, the institution may be better off by buying a structured note that pays better coupon than normal bond of equivalent credit quality, thus "enhancing" its yield.

Derivatives can also effectively be used to customize institution's payoff profile. For example, institution, that is happy with a certain level of investment returns can "sell off" the upside by writing call options on the underlying assets and thus pocket up-front premiums, enhancing its current yield. In this case derivatives provide means to find payoffs that would otherwise not be available in the market.

Another practical motivation could be market timing since besides improved liquidity in certain markets, derivatives do offer flexibility in timing the trades. A pension institution expecting to buy German government bonds after certain, for example auction, date may essentially buy the bonds already today in the futures market if it thinks that the current futures price for the bonds is attractive.

Finally, management incentives in the pension funds may motivate for speculative derivative strategies. For example some pension institution's portfolio managers may have their compensation tied to their investment performance. Now let's consider the case that institutions investment performance slightly lacks the compensation threshold a couple months before end of the financial year. In this case, managers may have the incentive to buy call options in the hope of windfall gains. In the worst case they would lose the option premium and make slightly more loss, and in the best case make decent returns for the year and get paid their performance bonuses.

3.3.4 Taxes and regulatory arbitrage

Without a doubt, one major motive for pension institution, and many other market participants, to use derivatives is for tax management and regulatory arbitrage. Partnoy (1997) defines regulatory arbitrage as "financial transactions designed specifically to reduce costs and capture profit opportunities created by differential regulations or laws." He notes that a party to financial transactions may use a variety of trading strategies to achieve the same economically equivalent position. Despite being equivalent in economic sense, these positions may qualify for different regulatory or tax treatments, and create a motive to structure suitable derivatives trades.

Finnish pension institutions are subject to extensive regulation in their investment operations (see section 4.4 for detailed analysis), and these regulations may spin off rather suspicious strategies from the regulatory point of view. For example, pension providers have a solvency capital requirement based on the riskiness of their asset portfolio. Increasing risk of the investment portfolio means that institution needs to contribute more to its solvency capital, limiting its investment flexibility and the amount it can pay to its sponsor (or clients). Instead of investing to equities outright, pension institution with tight solvency position may find it more beneficial to buy high credit quality equity-index linked structured note that needs less regulatory solvency

capital (see section 4.4.1). As a result the economic position of the institution may be the same (i.e. position in the equity market), but derivative strategy allows institution to benefit from regulatory arbitrage in the form of increased regulatory solvency position, flexibility and even lower contributions from the employers.

Similarly, Finnish pension institutions are subject to same capital gain and yield income tax treatment as any other businesses or investors. Similar to corporations, banks and other market participants, pension institutions may have an incentive to "smooth" their financial results from one year to another, and tax management is one component of this smoothing. Pension institutions aim for stable investment returns in the long run, but mismanagement of short-term risks may cause unexpected losses for a given year. As noted in the section 3.3.1 these losses can be costly for various reasons. Certain derivatives strategies can be used to gain higher accounting return now (e.g. higher coupon) in exchange for lower return later (e.g. lower coupon) to transform return or losses from one financial year to another.

Tax management and regulatory arbitrage is the grey area of derivatives market. Whereas some strategies may be completely prudent and rational, other strategies may constitute as an outright financial fraud. It is impossible to formulate perfect financial market regulations, and as Partnoy (1997) points out financial intermediaries are constantly structuring new financial innovations in response to changes in financial regulation. Consequently, pension institutions engaging into these activities need to be careful and managers need to be prepared to take responsibility from their actions in all occasions

3.4 Reasons not to use derivatives

Much of the academic literature has sought to explain why various economic agents engage into derivative activities, and outlined the benefits of the derivatives. However, there exist multiple practical, and somewhat interrelated, reasons why a pension institution may not choose to enter into derivative contracts and this section summarises them.

3.4.1 Aims can be met without

First and obvious argument why a pension institution is not using derivatives is that it does not need them. This means that if pension institutions management perceives its investment

objectives can be perfectly met with traditional investments, there is no need to enter the derivatives market. As demonstrated in the second section of this study, pension institution may achieve a good enough asset-liability fit through traditional asset allocation. For example, fully funded pension fund that is closed for new employees may find it simple and beneficial just to match its assets and pension liabilities by investing into low risk inflation-linked fixed income instruments. If pension institutions assets and liabilities move together both in the long- and short-run, there is no need to hedge risks, achieve better returns, or take advantage of regulatory loopholes.

Additionally, derivatives are only one component of effective risk management strategies, and an institution may find other alternatives suitable. For example, Ponds and Quix (2003) present that pension fund may choose to maintain high enough solvency position control the risk of short-term underfunding. Of course, question remains what is high enough solvency capital to avoid regulatory costs and costs of increased contributions in all scenarios.

3.4.2 Cost of using derivatives

There is a significant fixed cost component in using derivatives. These costs stem from the cost of setting up derivatives activities; the need for new human capital, computer systems and administration and risk management process, legal expertise, as well as regulatory and reporting compliance. Cummings et all (1998) argue that to the extent that these costs drive the derivatives usage, only the firms with large enough exposure would find it worthwhile to hedge their risks with derivatives.

These costs imply significant economies of scale in derivative activities. Only pension funds with large enough asset portfolios may justify the cost of entering into derivatives market. Additionally, institutions with larger and more diversified portfolios may have investment management expertise that is to some extent more easily transferable to derivative markets. Large pension insurance companies that already have managers and systems tracking hundreds of equity and fixed income positions, may find it easy to add derivatives into the mix. On the other hand, smaller company pension fund that owns shares in a few mutual funds may be less intimidated. Finally, once the decision to use derivatives has been made, the cost of taking incremental derivative positions is significantly less.

3.4.3 Increased risks

Another reason that may put off pension institutions from the derivative market, are the perceived risks that are associated with derivative instruments. Leverage component embedded into derivatives means that are capable to cause large losses if not prudently used. Although derivatives can actually decrease institutions risk level if used correctly for hedging purposes, there is always the operational risk and the human factor that can cause unexpected losses. Leveraged and unprofessionally managed derivative position does have the capability to knock out large portion of the solvency capital of a pension institution.

Secondly, as already pointed out, line between risk reduction and speculation can be thin. Short-term hedging involves decisions such as timing and scope of hedging that require managerial view on the markets. Especially, if institutions managers view their derivatives positions in separately of the hedged assets, they may viewed as increasing institutions' investment risks.

Interesting viewpoint is also to extent of managerial risk aversion in pension institutions. Cummings et al (1998) argue that the lack of effective ownership control in mutual insurance companies can actually lead to managers to behave in extremely risk averse manner, placing high priority on avoiding or hedging risks that may threaten their job. If this is the case managers of Finnish pension insurance companies (and to some degree pension funds) may perceive risks associated with derivative activities as higher than they are, and limit or put off their participation in the market. On the other hand, managers also may have an incentive to "overhedge" their investments with derivatives if they have an opportunity to do so.

3.4.4 Lack of expertise and resources

Even if a pension institution has invested into setting up derivatives activities, the lack of expertise from different instruments, and the lack of resources devoted to these activities may limit the volume and types of the derivatives the institution uses. Derivatives exist in various degrees of complexity, all requiring various degrees of financial sophistication from their users. For example, Derman (2001) demonstrates that even the valuation of certain derivatives positions can be a daunting task that requires suitable skills in the pension institutions' organisation. Lack of understanding of rationales and valuation of certain instruments, poor

understanding of the terms of the derivative contract, or even personal and organisational issues may prevent pension institutions to use derivatives optimally.

3.5 Previous empirical evidence on pension institutions' derivative activities

Given their huge size and activity in the capital markets, surprisingly little is known about the derivative activities of pension institutions, both internationally and in Finland. Empirical studies on the issue seem to be mainly driven by the financial intermediaries' business needs, rather than academic curiosity. Unfortunately many of these studies are hard to obtain for academic purposes. Additionally, even though institutions in many countries, in Finland as well, are required to report their derivative position for regulatory purposes, this information is not available for academic or business purposes[2]. This study seeks to fill this gap in public knowledge. Additionally, as a consequence and similarly to this study, most of the previous empirical research has relied on survey methodology.

Levich et al (1998) survey derivative and risk management practises of the U.S. institutional investors, among their target population 1,000 pension plan sponsors. They find that 63% of pension plan sponsors in the sample permit their asset managers to use derivatives. They also report that notional values of pension plans' derivative positions tend to be small, on average around 5% of the total assets. Survey also reveals that main motives for derivative usage are risk reduction (55% of the respondents), asset allocation (26%) and achieving incremental returns (15%). Respondents were mainly concerned about the management of the foreign equity, bond and foreign exchange risks. Most commonly cited reason for not using derivatives was that institutions' investment objectives could be met without them. Almost as many institutions cited "increased investment risks" as a reason for not using derivatives.

Levich et al (1998) also summarise responses to other surveys of the pension institutions' derivatives usage, many of which are conducted by private organisations. Table 3.1 presents their findings.

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[2] For example, Finnish Insurance Authority refused to give information from the quarterly derivatives reports that they collect from Finnish pension institutions

Table 3.1 - Responses to the surveys on the use of derivatives by pension institutions

This table summarises responses to previous surveys on the use of derivatives by pension institutions as reported by Levich et al (1998). First column indicates who conducted the survey, second column type of the research organisation and third column the focus group of the study. Fourth and fifth column present their findings on frequency of the derivatives users, as well as top reason for using derivatives, respectively.

Survey	Research type	Focus group	Do You Use Derivatives, % who do	Top reason for using derivatives - % so indicating
NYU/Stern School of Business 1995	Academic	US pension and endowment funds with assets from $2.3-$3.3 bn	67%	Risk management - 70%
Record Treasury Management 1994/1995	Private	US pension fund managers	92%	Risk management - 31%
Institutional Investor 1995	Magazine	US corporate and public pension plan sponsors	52%	Risk management - 35%
Watson-Wyatt	Private	44 pension funds in 10 European countries	54%	Risk management - 54%
Record Treasury Management 1996	Private	Top 200 US pension plans	NA	Hedging/Risk reduction - 62%
National Association of Pension Funds 1996	Lobbying group	750 UK pension funds	NA	NA
WSJ-Watson-Wyatt 1996	Newspaper/Private	68 European pension funds	NA	NA
Institutional investor 1997	Magazine	800 corporate and 250 public pension plan sponsors in the US	48%	Hedging returns - 48%
Greenwhich associates 1998	Private	92 Canadian pension funds	47	NA
Levich et al (1998)	Academic	13,500 Institutional investors in the US, among them 1 000 US pension plans sponsors	Population estimate for pension plans: 36.4%	Risk reduction/Hedging - 55%*

*Proportion responding "Very often or often" (Levich et al 1998)

Clearly the proportion of institutions using derivatives varies from sample to another. Nevertheless, these studies show that over 50% of the US pension funds report using derivatives, and around 50% in the UK and Canada. Watson and Wyatt report that similar proportion (54%) of European pension institutions use derivatives. These previous results seem to imply that institutional and regulatory differences between these areas seem to have a minor role in pension institutions derivatives usage. Based on these studies it is expected that around 50% of Finnish pension funds report using derivatives.

Puttonen and Torstila (2003) survey risk management practises at 20 Finnish corporate pension funds. They report that 65% of the surveyed pension funds allow short-term hedging using derivatives, but do not report actual or surveyed usage data. However, they conclude that a representative comment on hedging was that "In theory we are allowed to use short term hedging but since pension funds are long-term investors we do not take risks to burn money in short-term hedging because timing of such hedges is always uncertain. This suggests that perceived risks, and to some extent lack of managerial expertise, are factors influencing derivative strategies of Finnish pension funds. This study seeks to explore what these factors actually are.

Surprisingly, instead of asset-liability mismatch, respondents perceived equity and bond price risks as the major risks. This implies that contrary to contemporary literature on the importance of asset-liability management in pension funds, many corporate pension funds still focus on managing the asset side of their balance sheet.

Interestingly, Torstila and Puttonen (2003) also report that Finnish corporate pension funds extensively use external portfolio managers and mutual funds. These pension funds use on average 8.7 mutual funds and have 2.7 discretionary portfolio management contracts with external portfolio managers. Consequently, many pension funds may not even be aware of the derivatives position in their portfolios, or do not report them as such, since many of the mutual funds use derivatives. Naturally this complicates empirical studies on the issue.

Käppi and Puttonen (1995) survey the derivative usage of Finnish mutual funds and conclude that 58% of the funds use derivatives, 41% mainly for hedging and 17% mainly for speculative motives. On the other hand, Koski and Pontiff (1998) report that only 28% of US mutual funds use derivatives, considerably less than in Finland. Fortunately, from pension institutions' point of view, question whether the mutual funds they use employ derivatives or not may be irrelevant. Koski and Pontiff (1998) compare the return characteristic of funds, and find that derivative users do not differ from the funds that do not use them.

Because the pension insurance companies manage majority of Finnish pension benefits, evidence on the derivative practices in the insurance industry is also relevant for this study. Cummings et al (1998) report that only 10.9 percent of US life and 6.9 percent of property and casualty insurers use derivatives. More importantly, they conclude that theories of corporate risk management are relevant also in insurance industry. For example, they find that insurers use derivatives to reduce expected cost of financial distress, suggesting that derivatives usage is related to the solvency position of a pension institution. Hoyt (1989) surveys the use of financial futures by life insurers, and concludes that there exist statistically significant differences in perceptions of users and non-users. He finds that derivatives users feel strongly that proper use of financial futures can reduce financial risk facing their companies and that benefits of using futures outweigh the costs. Not surprisingly he reports that non-users are relatively neutral with regard to value using futures.

Finally, all papers on the scope and rationales of derivatives usage seem to outline the important of scale economies and the cost of entering into derivatives markets. Levich et al (1998) find that higher proportion of large institutions (71%) than small institutions (26%) uses derivatives. Cummings et al (1998) reports that insurance companies using derivatives have significantly larger risk exposures, justifying investment to setting up derivative activities. Hoyt (1989) reports lack of qualified personnel and problems educating management as main reasons not to use derivatives in US life insurance industry. Similar results arise in the corporate risk management literature (e.g Nance et al 1993, Mian 1996, Gezcy et al 1997). Given the dominance of large pension insurance companies, and the small average size of Finnish corporate pension funds these scale economies are expected to main issue for Finnish pension institutions.

This section has summarised theoretical and empirical literature on pension institutions in the derivatives market. However, for the hypothesis development more detailed understanding of the Finnish institutional, and regulatory framework is needed and presented next.

4 Overview of the Finnish institutional framework

The organisation of the Finnish pension systems provides a regulatory and institutional context for the derivative activities of Finnish pension institutions. Moreover, understanding the unique characteristics of the Finnish system is integral for the hypothesis development for the empirical part. This fourth section gives an overview of the relevant Finnish pension regulations and analyses how they affect institutions use of derivatives. Existing academic literature on the Finnish pension institutions is also reviewed.

4.1 Overview of the Finnish pension system

The three pillars introduced in the second section can characterize Finnish pension system. First pillar consists of the employment-based earnings-related pension provision and the residence-based national pension. As opposed to many other countries, second-pillar employee specific pension provision and third-pillar private pension insurance are pretty rate in Finland (Hietaniemi, Vidlund 2003). Hietaniemi and Vidlund argue that this is because there is no upper limit in euros for the pensionable earnings and thus for the pension in the first pillar.

In the first pillar, residence-based national pension guarantees a minimum income for resident persons who are not entitled to an earnings-related pension or for those whose earnings-related pension would be too small (Antolin, Oxley, Suyker 2001). The target level of Finnish pension is 60 percent of the pensionable earnings, and at low-income levels national pension supplements the earnings-related pension scheme (Hietaniemi, Vidlund 2003). This national pension scheme is managed as a pure pay-as-you-go scheme by the Social Insurance Institution (Kansaneläkelaitos, KELA) and consequently the scheme is beyond the scope of this study.

Main building block of the Finnish pension system is the earnings-related pension in the first pillar. All gainful employment has to be insured in some pension scheme and accrues a pension. Earnings-related pension is of a defined-benefit nature, and it consists of all the pension rights the individual has accrued. These pension benefits are based on annual earnings and accrual rate (Ilmakungas, Vanne 2004). Accrued pensions are financed jointly by the contributions from employer and employee as a percentage of the salary.

Ilmakungas and Vanne (2004) outline some of the unique characteristics of the Finnish pension system. Firstly, the administration of the statutory earnings-related scheme is entrusted with private pension providers. They highlight that Finnish system is among the few first-pillar schemes where there is competition within the scheme. Secondly, the Finnish pension system is partly funded with current funding amounting to nearly 60 percent of the gross domestic product. Ilmakungas and Vanne (2004) call the Finnish system as an "intermediate alternative" between government controlled central pension fund and individual retirement accounts.

Next this study takes a closer look on these two unique characteristics and how they affect the institutional framework. where Finnish pension institutions operate.

4.2 Administration of the Finnish pension system

Earnings-related pension scheme can be further divided into pension provision for the private and public sector employees. As highlighted in the previous subsection, the very special feature of the Finnish social security is that private insurance providers handle the private sector of the statutory scheme. These private-sector pension providers are supervised by the Ministry of

Social Affairs and Health and by the Finnish Insurance Supervisory authority (Hietaniemi, Vidlund 2003).

In practice this means that a private sector employer can choose how the pension insurance is arranged to employees. First, insurance can be taken out with one of the six big pension insurance companies. These include Eläke-Fennia, Pension-Ålandia, Ilmarinen, Tapiola, Varma, and Veritas. Another large pension insurance company is Etera that manages pensions under the Temporary Employees Pensions Act. (Vakuutusvalvonta 2005). Ilmakangas and Vanne (2004) report that 85% of employed individuals are in plans managed by these seven insurance companies.

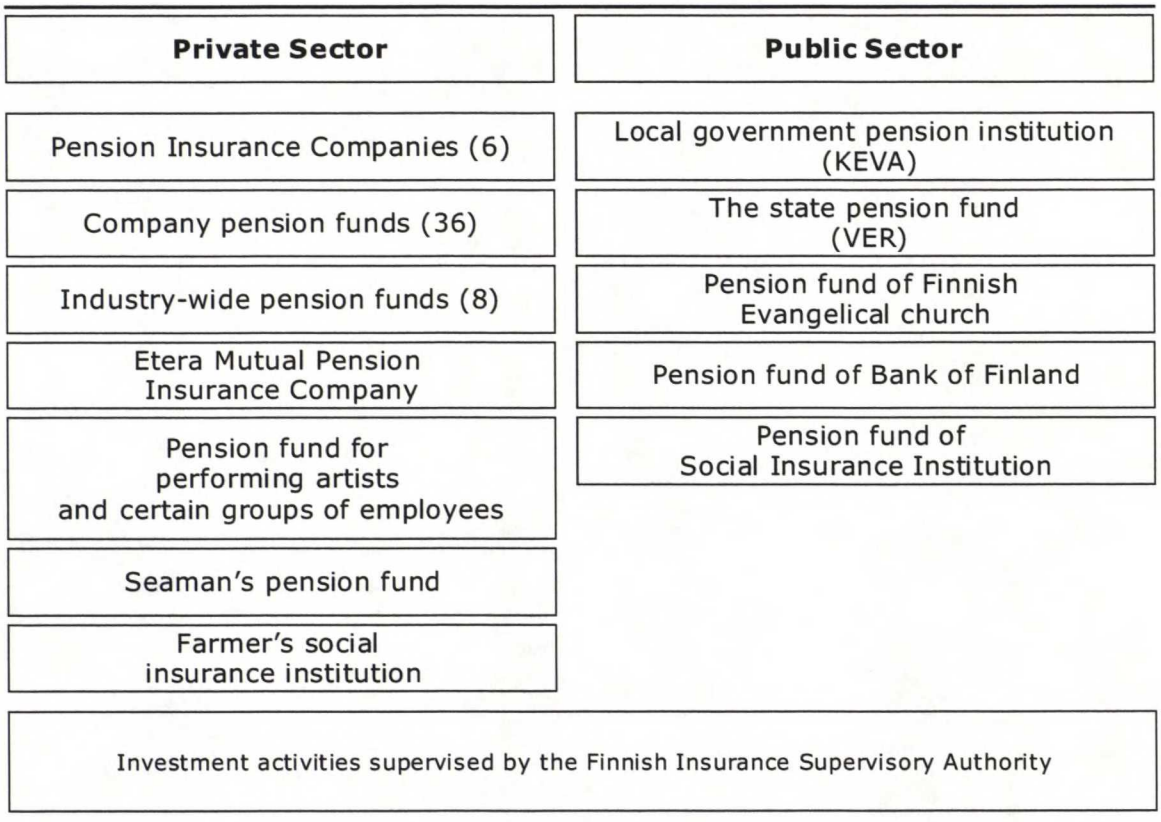
Another option would be to set up company's own pension fund or to join industry-wide pension funds. At the end of 2002 there were 36 company affiliated pension funds and 8 industry-wide pension funds in operation (Hietaniemi, Vidlund 2003). Finnish terminology here may be a bit confusing, since term pension fund can be used for both pension foundations (Eläkesäätiö) and pension funds (Eläkekassa). Despite they are governed by different acts, the nature of these institutions is the same as of Anglo-American pension funds.

Public sector pension provision is administrated by a number of public pension institutions. Local government pension institution (Kuntien eläkevakuutus, KEVA) provides pension for local governments employees and is supervised by the ministry of the interior (KEVA 2005). The state pension fund (Valtioneläkerahasto, VER) is an investment organization that handles the earnings-related pension scheme funding for state's employees (VER 2005). Additionally, Finnish Evangelical church, the Bank of Finland and the Social Insurance Institution have their own pension schemes (Hietaniemi, Vidlund 2003).

Figure 4.1 adapted from Risku (2003) summarises administration of the Finnish earnings-related pension scheme, and gives an overall picture of the focus group in this study.

Figure 4.1 - Administration of the Finnish earnings-related pension scheme

This figure summarises administration of the Finnish earnings-related pension scheme. Institutions that manage funds for the private sector pension schemes are listed on the left side of the figure. Institutions that manage funds for the public sector schemes are listed on the right. Finnish supervisory authority supervises the investment activities of both private and public sector institutions.



Adapted from Risku (2003)

4.3 Financing of the Finnish pension system

Lindell (2003) provides a good description how Finnish pension system is financed. Essentially, Finnish pension system is financed by the joint contributions from the employer and employee. These contributions are determined as a percentage of the salary, and employee contributions vary by his age, and employer contributions vary by the pension insurance provider he chooses.

As noted, Finnish pension financing is characterised by the partial funding system. This means that a portion of the contributions are pooled into the pay-as-you-go scheme that pays current pension benefits, and a portion funded to meet future pension obligations. Part of the contributions are funnelled into pension funds and invested into financial markets. Funded component then covers the future pension liabilities of the pension institution, i.e. pension

insurance company or pension fund, where the employer arranged the pension insurance for his employees. Pay-as-you-go portion of the pension financing is arranged through a joint pooling mechanism between the pension providers. This mechanism is centrally coordinated by the Finnish centre for pensions (Lindell 2003). Needless to say, focus of this study is on the funded component of the Finnish pension system.

Actuarial principles for determining pension liabilities for Finnish pension insurance companies and pension funds are laid out the insurance companies act and in the earnings-related pensions act (Lindell 2003). The liabilities side of pension institutions consists of the net present value of the funded pension benefits, as well as several buffers, including the solvency capital as a buffer against investment risk (Ilmakungas, Vanne 2004).

Finnish peculiarity is that the present value of the future pension liabilities is calculated using technical rate of interest confirmed semi-annually by the Ministry of Social Affairs and Health. This rate is common to all pension providers, and it is accepted after hearing contributors to the pension schemes, i.e. employers' associations and trade unions. The minimum technical rate is 3 per cent annually (Ilmakungas, Vanne 2004). Lindell (2003) states that this rate follows general interest rate environment, and that the available yield on the pension providers' investments are to be taken into account when determining this rate.

With this premise, it may seem that the portfolio management of the Finnish pension institution is a no-brainer with little room for derivative strategies and financial innovation. If only Finnish liabilities regulations are taken into account, the best investment strategy would be to match institutions assets and liabilities. This simply means investing the funded contributions into risk-free bonds that yield over the technical rate of interest.

Fortunately for this study, the second important feature of the Finnish pension system is its competitive nature. Ilmakungas and Vanne (2004) note that pension providers run their portfolios and choose allocation independently each other, taking into account the structure of their liabilities, the solvency regulations, target allocation and return requirement set by their board.

As a consequence, the short-term contribution rate of the client of the pension institution, i.e. employer, depends on the investment performance of the institution. This investment performance is reflected in the bonuses, i.e. refunds on already paid contributions that granted to client of pension insurance companies or to the sponsors of company or industry-wide pension funds. Of course, in case of bad investment performance higher-than-average contributions have to be collected from the employer for pension institution to meet its solvency requirements. On the contrary, institutions managing funds for the public sector, i.e. mainly KEVA, VER and the church's pension fund, do not have to compete in the pension insurance market.

In brief, if a pension institution is successful in its investments, it is able to offer better bonuses to its clients, and consequently to attract more clients. According to Finnish Centre for Pensions, this competitive environment is meant to improve the efficiency of the Finnish pension system; investment returns, service quality and operational efficiencies (ETK 2005). Competitive dynamics may also provide the fundamental rationale for using derivatives strategies to improve institutions investment performance. This argument will be developed and examined further in the empirical part of this study.

Next subsection give a more detailed view on the investment activities of the Finnish pension institutions, gives an overview of the relevant regulations and analyses how this affects their investment activities and derivatives usage.

4.4 Impact of the regulation on pension institutions' investment activities

Independence of the pension providers, competitive environment and institutions' integral role in the society places high requirements on regulation of the Finnish pension system. Finnish pension institutions are governed by multiple acts and regulations that affect their investment activities. This subsection gives an overview of the Finnish regulatory framework and analyses how it affects institutions derivatives usage.

4.4.1 Regulatory bodies and acts

In general, pension institutions in Finland are regulated by several pension acts, categorized as acts of private and public institutions. Insured person's earnings-related pension may follow several different pension acts, depending on person's employment history. However, these

individual acts are beyond the scope of this study. More relevant is the regulation of the investment activities of the pension institutions.

Relevant regulations on the pension institutions' investment activities are included in various acts. Act on pension insurance companies (354/1997) has a chapter (9) on the investment activities of the pension insurance companies. Acts on Pension funds (1164/1992) and pension foundations (1774/1995) lay out similar principles for respective pension providers. Ministry of Social Affairs and Health has also given more detailed decrees on the coverage limits, as well as capital and solvency margin requirements that pose limits on the investment allocations. Additionally, public sector pension providers have their own regulations. (TELA 2005)

Despite various regulations, guiding regulatory principles for pension institutions investment activities are the same, according to the Finnish Pension Alliance (TELA 2005). Pension funds have to be invested productively and securely, institutions have to have a guiding up-to-date investment plan and investment activities are limited by regulations and authority supervision.

Main supervisory body of the Finnish pension institutions is the Finnish Insurance Supervisory Authority (ISA). ISA supervises the private-sector pension providers, and the investment activities of the public sector pension institutions. (Härkönen, Turunen 2003). ISA has independent decision-making power, but it is subordinated to the Ministry of Social Affairs and Health. Authority itself states that "The ISA monitors and checks that insurance and pension institutions abide by the law and good insurance practice and apply the proper procedures. It monitors and evaluates their financial position, management, control and risk management systems, operational preconditions and changes in their operational environments." (ISA 2005)

4.4.2 Solvency and coverage limits

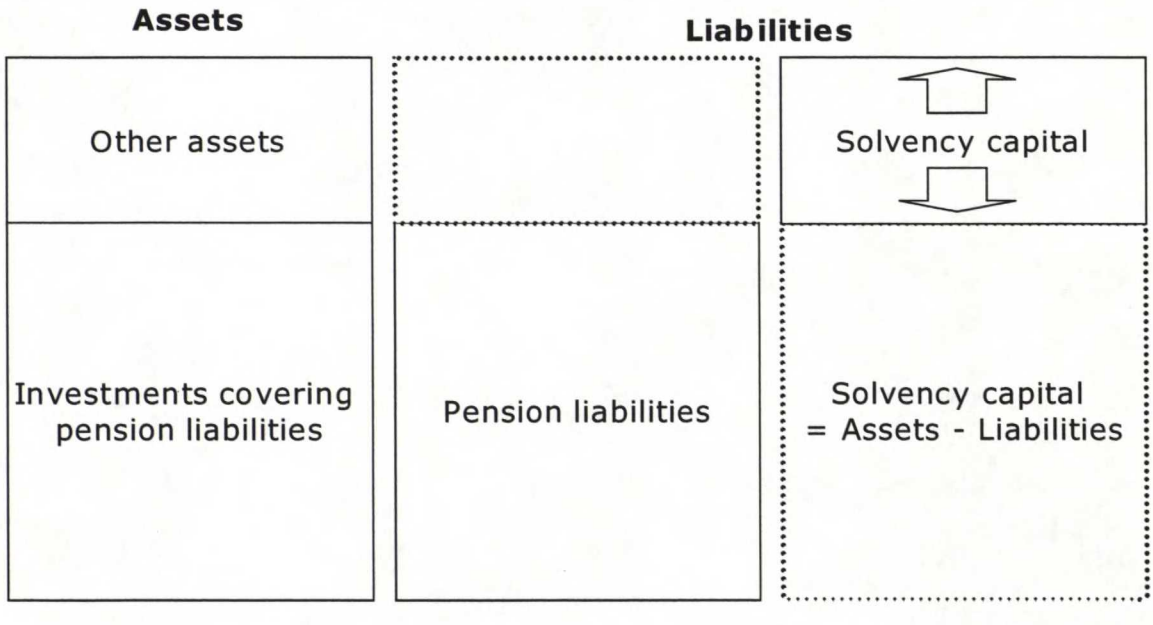
As pointed out in the previous sections, that the competitive nature of the Finnish private-sector pension provision gives an incentive to pension institutions to aim for higher investment returns. However, another special trait of the Finnish system is that the private-sector pension providers are jointly liable for the funded part of the accrued pension rights (Ilmakungas, Vanne 2004). In other words, if a pension provider goes into bankruptcy, the remaining pension providers are collectively liable for the lost pension benefits. Risku (2003) highlights that this joint and several

liability emphasizes the importance of supervising the solvency of the pension providers. In Finland regulations set limits to assets that can cover pension liability, as well as sets minimum requirements to pension institutions solvency capital.

The solvency capital requirement of Finnish pension institutions is based on the volume of their liabilities and the riskiness of their asset portfolios. Law defines the minimum requirements for institutions solvency margin that acts as a buffer against unexpected investment losses. Figure 4.2 explains the idea.

Figure 4.2 - Solvency capital in pension institutions

This figure describes the concept of solvency capital and its function as a buffer against poor investment returns. If return on investments on the assets side is poor, institution's solvency capital on the liability side deteriorates. Solvency capital requirements for Finnish pension institutions are defined by law.



ESY (2005)

To calculate institutions solvency margin target, its assets are allocated to seven categories according to their perceived risk level. A solvency capital requirement for each category is set by the Ministry of Social Affair and Health (STM 1999). These categories are outlined in table 4.1

Table 4.1 - Asset risk grouping in solvency capital calculations

This table summarises regulatory asset grouping in solvency capital requirement calculations. First column indicates risk group, second column characterises main assets included in the group, and third column summarises assets included in the group in more detail.

Risk group	Category	Description
Group 1	Money market	Loans for sponsoring company
		Governments
		Municipalities and other public entities
		Regulated banks and insurance companies
Group 2	Bonds, € denominated	Governments
		Municipalities
		Regulated banks and insurance companies
Group 3	Corporate bonds	Government bonds, other currencies
		Corporate bonds, publicly traded and € denominated
		Corporate money market instruments, publicly traded
		Other publicly traded bonds, € denominated
Group 4	Fixed income, other currencies	Banks and insurance companies
		Corporate bonds
		Other publicly traded bonds
	Real estate	Real estate, housing
		Timber assets and land ownership
Group 5	Real estate	Other real estate assets
Group 6	Equity	Publicly traded companies
Group 7	Others	All other assets

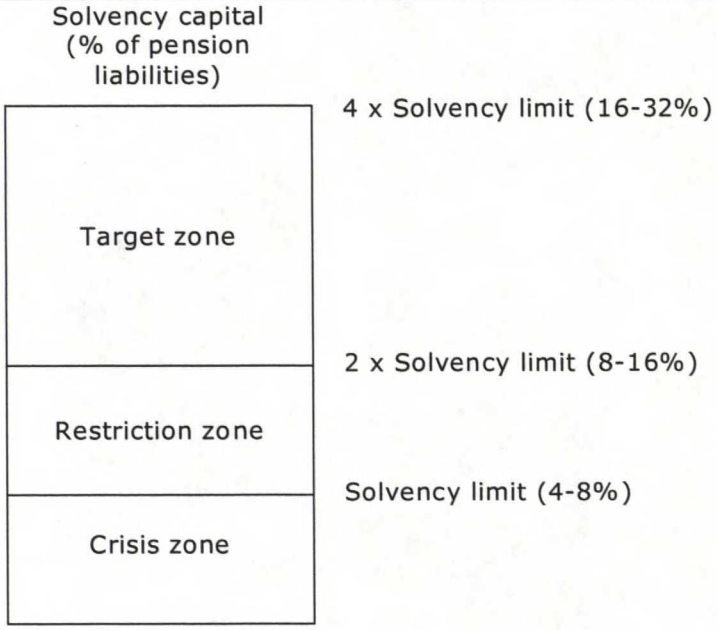
(STM 1999)

Higher solvency capital requirements are set for higher risk asset classes, and a target solvency margin zone is set on the basis of the institutions' asset portfolio. Solvency capital requirement is based on static coefficients defined in STM 1999, and thus do not represent real market volatilities or correlations. The lower limit of the target zone is the minimum requirement doubled, and higher limit is four times the minimum requirement. Figure 4.3 illustrates the solvency margin target zone concept

Figure 4.3 - Solvency capital limits and zones for Finnish pension institutions

This figure describes the concept of solvency capital and its regulatory limits and zones between them. Finnish pension institutions are required by law to hold a certain amount of solvency capital. Solvency capital limits are defined as percentage of the pension liabilities, determined by the risk level of the investment assets. Generally these limits fall within the ranges indicated in the brackets.

If institutions solvency capital exceeds the upper limit of the target zone, i.e. 4 x solvency limit, contributions to the pension institution have to decreased. If the capital falls below the lower limit of the target zone, contributions have to be increased. If the solvency capital falls below the solvency limit, i.e to the crisis zone, no bonuses can be paid out and the institution will have co-operate with the regulators to solve the situation.



If the pension institutions' solvency margin exceeds the upper limit of the target zone, institution must pay more bonuses to its sponsors, or their contributions have to be reduced. Correspondingly, in the restriction zone the pension institution have to reduce bonuses and in the crisis zone no bonuses can be paid at all.

Since the solvency margin targets are set by the riskiness of the asset portfolio, pension institution is able to reduce its solvency requirement by selling high-risk and buying low-risk assets. Also if institution wants to take more risk, say allocate more funds into equities, it has to account for increase in its solvency margin requirement.

In addition to solvency margin rules, regulators have set limits, for private-sector institutions that is, to asset allocation that can cover pension liability (STM 1998, 1995). According to law, these coverage rules are intended to ensure the security of the assets, their return and convertibility into

cash as well as the diversification of the assets (Risku 2003). Coverage limits are summarized in Table 4.2.

Table 4.2 - Coverage limits of Finnish pension institutions

This table summarises allocation limits to assets covering pension liability in Finnish pension institutions. First column indicates allocation limits as a percentage of the total pension liability, second describes the broad category of assets, and third summarises the content of the regulatory category.

Max allocation*	Category	Assets
100%	Fixed Income	Loans guaranteed by an EEA (European Economic Area) state
		Loans guaranteed by an EEA municipalities or other public entities
		Loan agreements guaranteed by a regulated bank or insurance company domiciled in EEA
		Funds investing only in above mentioned assets
		Loans collaterilised by assets in this category
50%	Corporate bonds	Loan agreements guaranteed by other than above mentioned banks or insurance companies
		Loans of corporations of which shares are publicly traded within EEA
		Other loans that are publicly traded in regulated markets within EEA
		Loans collaterilised by assets in this category
50%	Equity	Shares that are publicly traded in regulated markets within EEA
		Junior obligations of the above mentioned issuers
		Funds investing in above mentioned assets
		Loans collaterilised by assets in this category
40%	Real estate	Real estate assets within EEA
		Shares of real estate companies
Limits to risk exposures to individual names		
25%	Fixed income	Loans guaranteed by certain municipalities or financial institutions
		Investments to individual funds
15%	Real estate	Investments to certain real estate assets
5% + 10%	Equity	Shares and junior obligations of publicly traded corporations
		Loans collaterilised by assets in this category
Limits to foreign exchange risk		
20%	FX	Assets denominated in other currency than pension liabilities (in practice, euros), and are not fully hedged

*Maximum allocation as a percentage of total pension liability

Most interestingly, table 4.2 shows that the foreign exchange exposures of Finnish pension institutions are limited to 20% of the total pension liability by regulations. This can be a constraining limit to large pension institution aiming for efficient international diversification,

and as such, as should create demand for derivative strategies to manage currency risk separately to enable optimal diversification.

All in all, these coverage rules are rather arbitrary and do not necessarily reflect the riskiness of different assets, and to some extent may impair efficient investment policies. For example, pension institution may wish to allocate more than 50% to equities, or to allocate more then 20% of its assets to US fixed income and equity markets.

As a conclusion, these solvency margin and coverage rules may be one of the primary drivers of the derivatives usage of Finnish pension institutions. First of all, foreign exchange derivatives enable pension institutions to manage their foreign exchange risk separately from their asset allocation, enabling more efficient international diversification, potentially better investment returns and asset-liability match. Secondly, arbitrary and costly regulation may give an incentive to engage into regulatory arbitrage introduced in the section 3.3.4. For example, institution wishing to invest more than 50% to equities, or an institution wanting to avoid increase in the required solvency capital due to increased equity allocation, may simply buy a fixed-income instrument linked to equity markets. For the regulatory viewpoint, this structured note would appear as fixed income instrument issued by a regulated bank or public entity even though its main risk derives from equity prices.

To complicate analysis further, Finnish public-sector pension institutions do not have any explicit liability calculations or solvency constraints. Ilmakungas and Vanne (2004) note that this due to fact that they are more a pure buffer against unfavorable demography or employment development in the public sector. Simply put, they are allowed to take more risk and a prudent person type of regulation governs their investment process more. This means that local governments pension institution, state's pension fund and the church's pension funds can choose relatively freely their investment allocations. Risku (2003) argues that this has lead to relative overweight of equity investments. Recent asset allocation figures from the Finnish pension alliance show that is indeed the case. Public pension institutions have allocated total 44% of their investments into equities, against 25% of private sector (TELA 2005). Interesting question is how this major difference affects their derivative activities. To the extent that derivatives usage is driven by the competitive nature of Finnish private-sector pension system, regulatory arbitrage

and theories on corporate risk management, private-sector institutions would use derivatives considerably more.

4.4.3 Institution administration and investment plan

Finnish law also states that pension insurance companies and pension funds have to have a written investment policy, verified by the institutions' board of directors. Finnish Insurance Supervisory authority has further instructed how the investment plan should be formulated. (Vakuutusvalvonta 2003a, Vakuutusvalvonta 2003b).

Pension institution's board is ultimately responsible for formulating a written investment policy that steers institution's investment activities in practice, in a way that investment goals are achieved. Board has to monitor and revise this policy at least annually. Policy should have guidelines for (among others) return targets, diversification, foreign exchange risk, hedging and solvency margin targets.

Especially, the board has to specify and approve written principles on institutions derivative activities. According to ISA (Vakuutusvalvonta 2003) these principles should include: the purposes of the derivative usage, types of derivatives to be used, acceptable derivative strategies, acceptable counterparties, risk management responsibilities and systems, risk limits and reporting guidelines.

ISA has also given guidelines on the risk associated to derivative activities and how they should be managed (Vakuutusvalvonta 2003a and 2003b). In practice these guidelines are rather vague, and give institutions considerably flexibility how the risk is actually managed. For example, institutions have to specify credit risk limits to its counterparties in its investment policies and these limits must be controlled. Limits are calculated using simple method of fixed coefficients based only on the maturity and underlying asset class. However, detailed risk management regulation might be impossible to implement given the variety of activities and expertise of different institutions.

In a sum, the board of pension insurance company or pension fund is ultimately responsible for the investment policy, and thus derivative activities of a pension institution. Rules governing the administration of pension institution investment policy are not very detailed, but engaging into

derivatives activities may require significant modifications to the reporting and risk management responsibilities and systems within the pension institution.

4.4.4 Accounting for derivatives

In addition to Finnish accounting legislation, ISA also gives regulations on the accounting principles and practices regarding the use of derivatives (Vakuutusvalvonta 2003a and 2003b). These regulations are based on the historical accounting method (as opposed to fair value accounting principles implemented by publicly traded corporations within EU), but nevertheless apply some principles from IAS 39 - Financial instruments: Recognition and measurement.

These regulations allow the use of hedge accounting, i.e. viewing them together with the hedged asset for accounting purposes, for derivative positions that meet the IAS 39 requirements. These requirements are broadly:

- Appropriate initial documentation on the risk to be hedged and hedging strategy.
- Testing for the effectiveness of the hedge: changes in the cash flows and market values of the derivative position and underlying instrument should offset each other within 80-125 percent zone
- Effectiveness of the hedge can be measured reliably and continuously

If derivatives position qualifies these requirements, it can be accounted together with underlying asset to cover pension liabilities. Secondly, to be accounted this way derivative must be traded in regulated markets or be fully collateralised. Exceptions are foreign exchange derivative contracts where counterparty may be minimum A rated bank or insurance company. In essence, hedged asset can be valued using its hedged value instead of its stand alone market value. Consequently, exchange traded derivatives, such as interest rate and equity index futures, as well as OTC FX derivatives should be major hedge method for pension institutions using derivatives. More innovative OTC structures, such as exotic derivatives, are not accounted to cover pension liability and may require costly collateralisation.

ISA also explicitly states that it is allowed to write call options on coverage assets. In this case the coverage value of the underlying asset is calculated using the option strike price if it is less

than the market value of the asset. Some institutions may thus write options to boost their current investment returns.

Additionally, while stand-alone derivatives do not cover any pension liability, structured notes are counted in coverage and solvency calculations. ISA vaguely notes that requirement is that "market value of the derivative element is not significant proportion of the such a instrument." Furthermore, capital guaranteed structured notes are parallel to other obligations from the same issuer for regulatory purposes. In other words, as long as the issuer, say a financial intermediary, promises to pay full principal amount at the maturity, the note is regarded as high quality fixed income instrument even though its coupon may be linked to any market variable. Consequently, these accounting principles together with coverage and solvency margin rules may drive the demand for structured derivatives, especially capital guaranteed notes.

Finally, pension institutions are obliged to value their derivatives portfolios at least quarterly for regulatory purposes. Many smaller institutions may find it hard to value their derivative positions if the instruments are not publicly traded, i.e. OTC-derivatives. ISA states the valuation of such derivative positions may be based on the present value of the cash flows or option valuation models. However, in many cases such valuation methods may require quite extensive financial sophistication in order to be reliable, and this adds to the cost of using derivative instruments. Valuation difficulties may also be one reason for not using derivatives.

5 Survey methodology

This section first describes the empirical methodology used in this study. First, the survey methods that were employed to obtain previously undisclosed data of pension institutions' derivative activities are presented. Then hypotheses on why these institutions may and may not use derivatives, based on pension institution literature reviewed in the previous sections, are formulated. Finally, statistical methodology used to interpret survey responses and to test the hypotheses is explained.

5.1 Survey population and response rate

Empirical part of this study is based on the survey on the derivatives usage by Finnish pension institutions conducted in March - April 2005.

Survey population is all pension institutions managing funds for Finnish pension system, excluding voluntary pension schemes (i.e. A-sections of TEL-pension funds), as reported on the website of Finnish Insurance Supervisory Authority on 1/1/2005. Population consists of 7 pension insurance companies (Työeläkevakuutusyhtiöt), as well as 47 corporate pension foundations (Eläkesäätiöt), corporate pension funds (Eläkekassat) and industry-wide pension funds. 7 special pension institutions; The Local Government Pension Institution (KEVA), The State Pension Fund (VER), The Pension Fund of the Finnish Evanchelical Church, Farmer's Pension Fund (MELA), Seamen's Pension Fund (Merimieseläkekassa), The Pension Fund of the Bank of Finland, The Pension Fund of the Social Insurance Institution of Finland (KELAn eläkerahasto), are also included in the survey population. All in all, survey population consisted of 61 institutions grouped into three categories: 1) Pension Insurance Companies 2) Pension Funds 3) Special Pension Institutions as described above.

Survey was rather well received and 54% of the survey population choose to participate. Table 5.1 presents survey population and response rates for each category.

Table 5.1 - Survey population and response rate

This table reports the population and response rates of this survey. Survey population consisted of the Finnish pension institutions that were grouped into three categories: 1) Pension insurance companies 2) Pension Funds, including pension foundations, pension funds and industry-wide pension funds and 3) Special Pension Institutions. First column reports how many institutions were included into survey population and the second column indicates how many qualified responses were attained from the group. Third column reports the overall response rate and final column briefly characterises the institutions included in the group.

	Population N	Survey N	Response rate	Description
Pension Insurance Companies	7	5	71%	Insurance institutions regulated by the Finnish act on pension insurance companies
Pension Funds	47	22	47%	Pension funds (Eläkekassat), Industry-wide pension funds and pension foundations (Eläkesäätiöt) managing funds for the TEL B-division, I.e. mandatory pension insurance
Special Pension Institutions	7	6	86%	Other institutions managing funds for the Finnish pension system
Total	61	33	54%	

Institution size and its expertise seemed to be relevant factors in determining participation in the survey. Many pension funds cited their lack of expertise on the issue as a reason not to participate. Consequently, response rate among corporate pension funds, which are on average

much smaller and less experienced in the derivatives markets, were lower than in other two groups.

Relatively high response rate was driven by initial respondent screening by phone and multiple callbacks. Table 5.2 summarizes the overall response from the survey population.

Table 5.2 - Composition of the survey response rate

This table summarises the response from the survey population. First column indicates the number of responses obtained, second the number of institutions that explicitly declined to take part in the survey, and the third column the number of institutions that did not return the survey questionnaire. Fourth column summarises the number of institutions that had completely outsourced their portfolio management and were thus not eligible for the survey. Finally, the fifth column indicates the number of institutions were relevant respondents were not reached.

	Responses	Declined	Form sent, no response	Management outsourced	Not reached	Total Population
Pension Insurance Companies	5	1	1	0	0	7
Pension Funds	22	6	6	9	4	47
Special Pension Institutions	6	0	1	0	0	7
Total N	33	7	8	9	4	61
% of total population	54%	11%	13%	15%	7%	

At first, initial contact with all the institutions in the population was attempted via telephone. Contact information was obtained from institutional and corporate websites, and from the register of the Finnish Association of the Pension Foundations. Only 4 institutions were not reached after multiple attempts.

During this initial contact, the purpose and methodology of this study was explained to all institutions to screen for relevant contact persons. Aim was to obtain responses from the person best aware of institution investment policy and derivative activities. All institutions were able to point such a person, and 57 persons in total were contacted.

Secondly, all potential respondents were briefly interviewed on the phone to secure their goodwill towards the survey, and to check for their expertise. At this stage, pension institutions that had completely outsourced their investment management we excluded from the survey, 8 institutions in total. Additionally, 6 institutions in total declined to participate at this stage.

Finally, 42 survey questionnaires were sent to potential respondents. 33 institutions in total answered to survey questions after callbacks. Total response rate was thus 54 percent of total survey population, and 79% of questionnaires sent out. More importantly, survey respondents

represent 92 percent of the sector's assets under management[3], and thus this survey gives a good overview on the derivative activities by Finnish pension institutions.

As mentioned, respondents were once again screened in the survey questionnaire. All respondents reported being responsible for the issues researched in this study, further adding to validity of their responses. Table 5.3 characterizes the responsibilities of the respondents.

Table 5.3 - Responsibilities of the survey respondents

This table characterises the respondents of this survey. Each respondent were asked to indicate which of the responsibilities presented along the rows characterise his/her responsibilities. Columns on the right present the proportion of respondents in each institution category having responsibilities as indicated along the row.

	Pension Insurance Companies	Pension Funds	Special Pension Institutions	Total %
Directly responsible for institutions investment performance	100%	68%	83%	76%
Participated in the formulation of institution's investment and derivatives policy	80%	73%	83%	76%
Responsible for implementing and administrating institutions derivative activities	40%	32%	67%	39%
Total N	5	22	6	33

Respondents were working in various positions in their respective pension institutions. Commonly reported positions were CIO/Head of investments, investment/portfolio managers, Chairman of the board of pension fund, and Finance Director of the sponsor company. Nevertheless, all respondents reported being responsible for at least one of the areas shown in table 5.3. Naturally, many of them were responsible for more than one area in the table.

[3] TELA (2005) reports total assets under management in the Finnish pension sector of 88 billion euros on 31/12/2004. Survey respondents reported to manage total 80.8 billion euros.

5.2 Questionnaire design

Survey questionnaire that was sent out is attached as appendix 2. Questionnaire form was emailed to respondents as an Adobe Acrobat form, as well as identical Microsoft Excel-form to avoid technical problems. The questionnaire was divided into five parts: 1) Respondent information, 2) Descriptive statistics, 3) The use of derivatives, 4) Perceptions on the pension institution management and derivative instruments, and 5) Perceptions on the use derivatives.

After first screening for expertise, respondents were then asked to report descriptive statistics of their investment portfolio and activities. Data obtained includes total market value of their investment portfolio (as of 31/12/2005), solvency position, and proportional asset allocation. At this point, respondents were also asked to indicate whether the use of derivatives is permitted in their institution, and whether they used derivatives in 2004. This data is used to test between any differences in the characteristics of derivative users and not-users and partially answers to the second research question presented in section 1.2: What characteristics differentiate those institutions that use derivatives from those that do not use?

Thirdly, institutions that had used derivatives were asked to provide details on their derivative activities. This data reports what type of derivatives and on which asset classes respondents had used derivatives, total summated notional value of their outstanding derivatives positions, as well as usage frequency of various common derivative strategies. As such, this data answers directly to the first research question presented in the section 1.2: What derivative instruments Finnish pension institutions use, and what derivative strategies they have utilised?

Finally, respondents were asked to indicate their agreement with various statements relating to the pension institution management and use of derivative instruments on a seven step Likert scale. Alternatives were from disagree (1) to agree (7). Respondents were also given option of not taking any opinion by ticking 4 (do not agree or disagree). This method allows testing for overall relevance of the statement, i.e. statistical difference from 4, and for differences in perceptions between derivative users and not-users, i.e. statistical difference in the group means. Analysis of this data answers to the third research question presented in the section 1.2: What motivates pension institutions to use derivatives, and why some institutions do not use them at all. Data also supports the answer to the second research question.

5.3 Hypotheses

To explore what characteristics differentiate institutions that use derivatives from those that don't, and to explore why some institutions choose to participate derivative market while others avoid them, a set of hypotheses are tested empirically. This section outlines these hypotheses and explains how questionnaire form used provides data for hypothesis testing

The aim of the empirical part of this study is to measure and test following hypotheses:

H1: *Derivatives are used to hedge risks*

To the extent that derivatives are used to hedge short-term risks, their users have to be more concerned about the short-term risks of their institution. Consequently, derivative users should have riskier investment portfolio including larger allocation to equities and non-euro denominated assets, as well as lower allocation to money market and fixed income instruments. Derivative users should also have lower solvency position, as proxied by their Z-score, i.e. solvency capital divided by the lower limit of the regulatory capital requirement. Users should also score higher on these risks in question 13, as well as 14.1. Finally, large proportion of derivative users should use forward and futures as hedges.

H2: *Derivatives are used to diversify assets to new markets*

Derivatives can be used to diversify assets to new markets and to avoid capital markets imperfections. In this case, derivative users should score higher in questions 14.3, 14.5, 16, and 17. Large proportion of derivative users should use structured derivatives to this purpose.

H3: *Derivatives are used to enhance returns*

Derivatives are an efficient tool to enhance yield to assets and to take speculative positions, and a question is to what extent pension institutions engage into such activities. If pension institution use derivatives from these speculative motives, the users should score higher on question 12.1, 14.2, and lower on question 23. Large proportion of derivative users should use forwards and futures to take additional exposures, as well structured derivatives to express their market views.

H4: *Derivatives are used for regulatory arbitrage*

As demonstrated in the pension institutions and derivative market literature, arbitrating inefficient regulation has been a one major driver of derivate activities. In this case derivatives should be viewed to increase the flexibility to plan and manage taxes, to improve solvency margin, and overall current regulations should be viewed to promote derivative activities. Three statements in the questionnaire, questions 19, 20 and 29 attempted to capture these motives.

> ***H5:*** *Some institutions are not using derivatives because they think that cost of using them outweighs the benefits.*

Setting up derivatives activities, as well as administrating these instruments, incurs additional costs, such as acquiring necessary expertise, building systems and process. Moreover, many institutions may think that benefits from derivative instruments do not justify this cost. They can meet their aims very well by traditional instruments. In this study, total market value of institutions investment portfolio is used as a proxy variable of these benefits and ability to bear this cost. Larger institutions should use more often derivatives, as well as have larger notional value of them outstanding. Additionally, various statements in the questionnaire were designed to measure these benefits and costs: Question 15 directly measures factors limiting derivative activities, as do questions 27 and 28. Questions 21-24 measure benefits to be gained from derivative instruments.

> ***H6:*** *Some institutions are not using derivatives because they think that using derivatives increase their risks*

Although derivatives can be used to hedge investment portfolio from financial risks, there are risks associated with them. Especially for institutions with limited expertise, these risks can limit and prevent them from using derivatives instruments. Questions 24-26 attempt to capture these perceptions.

Finally, institutions were asked to give their opinion on two statements (Questions 29-30) how Finnish pension institution regulation affects their derivative activities.

5.4 Statistical methodology

This study applies common marketing research methodology to research problem derived from theoretical finance literature. As pointed out in the section 1.2, this study aims is to explain how institutional characteristics and managerial perceptions relate to the observable behavior of the Finnish pension institutions. Data is obtained and perceptions quantified using structured survey questionnaire.

First, descriptive characteristics and their statistical properties are reported and analyzed to give an overview of the Finnish pension institutions and their activities. Additionally, the frequency of use of derivatives, as well as data on the derivative instruments and strategies is reported. Differences in the derivative strategies between different institution categories are explored.

Secondly, univariate test are conducted on all variables, i.e. the variables are tested in isolation from other variables. Statistically significant differences in the descriptive statistics and perceptions between derivatives users and non-users are tested using two independent samples t-test. Additionally, all perceptions are tested for any statistically significant deviations from 4 (do not disagree or agree) to map out overall opinions of the respondents. This is tested using simple one-sample t-test.

Thirdly, interaction among the variables is analyzed within multivariate framework. First, all variables that did not show statistically significant differences between the two-groups are excluded from multivariate analysis. Then correlations among these variables are examined. Additionally, principal component analysis is used to reduce the number of variables measuring institution's perceptions, as well as to create new set of non-correlated variables. These principal components may also interpreted as "psychographic" profiles of the Finnish pension institutions.

Fourthly, institutions decision whether to use derivatives or not, i.e. participation decision, and how much to use these, i.e. volume decision, are examined using regression models. Selected descriptive variables and principal components are used as independent variables in binary logistic regression in an attempt to explain what factors affect the pension institutions' decision to use or not to use derivatives. Dependent variable is 0, if institution is not using derivatives, and 1, if institution is using derivatives. Then factors affecting institution's decision on the volume of their derivative activities are examined using linear OLS-regression.

Finally, hypotheses presented in the section 6.3 are accepted or rejected using univariate and multivariate analysis together with subjective judgment.

6 Empirical Results

This section presents the results of the 2005 survey on the derivatives usage by Finnish pension institutions.

6.1 Descriptive statistics

6.1.1 Institutional characteristics

Table 6.1 reports the descriptive statistics of the pension institutions that participated into the survey

Table 6.1 - Descriptive statistics of the respondents

This table presents the descriptive statistics on the characteristics of the survey respondents, 31 institutions in total. Respondents were asked to report the total market value of their investment portfolio (Total assets), as well as their solvency position, i.e. solvency capital divided by the regulatory lower limit (Z-score).

Respondents also reported their portfolio allocation as % of their total portfolio, divided into 6 categories: 1) Money market instruments = cash and fixed income instruments with less than one year to maturity 2) Fixed Income = all bonds with maturity more than one year 3) Equities = all listed equity investments 4) Real Estate assets = Real estate, land, timber and related investments 5) Lending = Loans to real estate companies, corporations or equivalents and 6) Other investments = Investments to unlisted companies, hedge funds, bonds with substantial derivative component or any other investments not included to categories 1) - 5). Respondents were also asked the total proportion of assets denominated in other assets than Euros (Non-euro assets).

Finally, if the institution were using derivatives in 2004, it was asked to report the aggregate notional value of its outstanding derivatives positions as of 31/12/2004 (Derivatives Notional).

Variable	N	Mean	Median	Stdev	Min	Max	Kurtosis	Skewness
Total Assets (1 000 €)	33	2,448,086 €	407,000 €	5,320,991 €	3,000 €	21,233,000 €	6.54	2.72
Z-Score	25	4.17	2.78	4.66	1.90	24.60	16.55	3.88
Portfolio allocation								
Money Market	33	11.44%	5.40%	16.69%	0.00%	81.30%	9.14	2.80
Fixed Income	33	38.24%	44.00%	18.94%	1.80%	77.00%	-0.83	-0.07
Equities	33	28.77%	26.00%	14.16%	0.00%	72.40%	1.96	0.96
Real Estate	32	13.25%	12.05%	10.40%	0.00%	36.60%	-0.56	0.57
Lending	33	5.64%	0.90%	9.18%	0.00%	32.20%	2.16	1.81
Others	33	3.48%	1.00%	4.68%	0.00%	18.00%	2.02	1.59
Non-euro assets	33	3.91%	2.00%	4.89%	0.00%	19.00%	1.26	1.27
Derivatives notional	16	8.24%	3.77%	10.21%	0.00%	33.23%	1.99	1.62

Similar to previous international studies (e.g. Levich et al 1998), the notional size of the derivatives positions was relatively small. Additionally, the average solvency position of the pension insurance companies and pension funds was quite good with average z-score, i.e. solvency capital divided by the regulatory lower limit, at 4.71. However, this distributions was very skewed with median z-score being 2.75 and thus within the target zone.

Most importantly, table 6.1 highlights how different the institutions were in terms of their descriptive characteristics, as evident in relatively high standard deviations and kurtosis of the variable distributions. It is thus more worthwhile to analyse these characteristics by institution categories as reported in table 6.2.

Table 6.2 - Descriptive statistics by institution category

This table presents the descriptive statistics on the characteristics of the survey respondents by institution category. Finnish pension institutions were grouped into 3 categories 1) Pension Insurance Companies = companies regulated by the Finnish act on pension insurance companies, 2) Pension Funds = corporate pension foundations, pension funds and industry-wide pension funds and 3) Special Pension Institutions = all other pension institutions.

Respondents were asked to report the total market value of their investment portfolio (Total assets), as well as their solvency position, i.e. solvency capital divided by the regulatory lower limit (Z-score).

Respondents also reported their portfolio allocation as % of their total portfolio, divided into 6 categories: 1) Money market instruments = cash and fixed income instruments with less than one year to maturity 2) Fixed Income = all bonds with maturity more than one year 3) Equities = all listed equity investments 4) Real Estate assets = Real estate, land, timber and related investments 5) Lending = Loans to real estate companies, corporations or equivalents and 6) Other investments = Investments to unlisted companies, hedge funds, bonds with substantial derivative component or any other investments not included to categories 1) - 5). Respondents were also asked the total proportion of assets denominated in other assets than Euros (Non-euro assets).

Finally, if the institution were using derivatives in 2004, it was asked to report the aggregate notional value of its outstanding derivatives positions as of 31/12/2004 (Derivatives Notional)

	Pension Insurance companies (N = 5)		Pension Funds (N = 21)		Special pension institutions (N = 5)	
Variable	Mean	Stdev	Mean	Stdev	Mean	Stdev
Total Assets (1 000 €)	€ 9,878,280	€ 8,908,990	€ 327,694	€ 277,415	€ 4,031,031	€ 6,275,844
Z-Score	2.51	0.50	4.70	5.25	N/A	N/A
Portfolio allocation						
Money Market	4.40%	2.57%	14.51%	19.65%	6.05%	5.52%
Fixed Income	51.24%	5.12%	35.30%	20.49%	38.22%	17.46%
Equities	23.44%	3.44%	26.74%	15.17%	40.67%	9.59%
Real Estate	13.12%	3.45%	13.04%	11.87%	14.10%	9.86%
Lending	4.78%	2.38%	7.37%	10.72%	7.37%	10.72%
Others	3.00%	2.85%	4.27%	5.37%	0.97%	1.50%
Non-euro assets	7.17%	4.93%	2.50%	3.19%	6.35%	8.03%
Derivatives notional	14.63%	8.98%	5.09%	10.68%	6.47%	5.42%

Pension insurance companies and special insurance institutions are characterised by their large size in terms of their investment portfolio. Largest insurance company had 22 billion euros of assets under management (AUM), and even the smallest company had 1.4 billion euros AUM. For special pension institutions these distribution of assets was heavily skewed toward larger institutions, since two largest institutions had 15.7 billion euros and 6.7 billion euros AUM, and others combined 1.5 billion euros. Even though that considerably larger number of pension funds participated in the survey, they were considerably smaller with average portfolio size of 337 million euros.

Lack of explicit asset allocation rules (see section 4.4.2) for special pension institutions seem to lead to them having larger equity allocation (41%) than insurance companies (23%) and pension

funds (27%) that are constrained by the coverage and solvency margin rules. However, the notional value of their derivatives positions was not higher.

Larger institutions, i.e. insurance companies and large special institutions had also allocated more of their assets outside euro area. This proxy of currency risk is larger in insurance companies (7.2%) and special institution (6.4%), than in pension funds (2.5%) This may hint that the perceived cost of diversifying internationally, such as following global markets and companies, may lead to lower non-euro allocations in pension funds.

Finally, derivatives positions of the institution that do use derivatives seem to be considerably larger in pension insurance companies. This may be a sign that they have more expertise in managing these instruments and thus take proportionally larger position. On the other this may also stem from the fact that that they simply use instruments, such as options, where notional value are larger.

6.1.2 Use of derivatives

Table 6.3 reports how many of survey respondents actually use derivative instruments.

Table 6.3 - The use of derivatives by Finnish pension institutions

This table presents the frequency of derivatives usage by Finnish pension institutions, as reported by the respondents. First row indicates the proportion of institutions answering yes to question: Is the use of derivatives permitted in your institution? Second row indicates the proportion answering yes to question: Did you use derivatives, including structured fixed income instruments, in 2004? Fourth row reports how many responses in total was obtained from each institution category, and the fifth row shows the overall response rates.

	Pension Insurance companies	Pension Funds	Special pension institutions	Total	Total %
Use of derivatives permitted	100%	82%	67%	27	82%
Used derivatives in 2004	100%	45%	33%	17	52%
Total Responses N	5	22	6	33	100%
Response rate	71%	47%	86%		54%

82% of survey respondents were permitted to use derivatives, but only 52% had utilized this mandate. Survey results are as expected, neatly in line with similar international studies, and show that Finnish pension institutions have started to use financial innovations in par with their international peers. Furthermore, in terms of assets, institutions that use derivatives manage 87%

of the Finnish pension capital included in the survey. Derivative activities and their regulation is thus important issue for pension sector regulators.

Notable detail is also that only pension insurance companies are fully utilizing the mandate to use derivatives. Actually the proportion of these companies using derivatives is significantly higher than reported in US studies (e.g. Cummings et al 1998, Hoyt 1989) a few years ago. Only 59% and 50% of Pension funds and special institutions permitted to use derivatives are actually using them, respectively. Obviously, there exist various reasons why managers have not decided to use derivatives even though they are allowed to do so. Based on initial telephone discussions with managers, these reasons seem to be related to the cost of using derivatives, such as acquiring required expertise. Additionally, many institutions are not large enough to qualify for relatively large notionals needed for derivatives trades[4].

Table 6.4 - The Derivative Instruments Used

This table reports the proportion of derivative users that used derivative instruments characterised below. Instruments are grouped by their type, as indicated along the rows, and by their underlying asset class, as indicated along the columns.

	FX	Interest rates*	Equity	Credit**	Total
Exchange traded futures on	0%	41%	35%	0%	53%
Over-the-counter forwards on	35%	6%	6%	12%	35%
Exchange traded options on	0%	24%	24%	0%	24%
Over-the-counter options on	18%	6%	12%	6%	24%
Swaps on	12%	12%	6%	12%	18%
Structured fixed income instruments*** which coupon or principal payment was totally, or partly linked to	24%	41%	65%	24%	65%
Total	53%	65%	82%	35%	100%

*Government bonds or other benchmark rates

**Corporate bonds or equivalent

*** unlisted bonds with material derivative component, e.g. principal protected notes with variable coupons, as well as notes with principal payment linked to one or more market variables, or any similar investments

Rather than simple futures and forwards (53% and 35% of derivatives users), the most popular derivative instruments that Finnish pension institutions use are often rather complicated structured derivatives (65% of users). From finance theory point of view, it may be a puzzle why so many of these long-term investors would be willing to pay hefty fees to financial

[4] For example, notional value for a single Bund future, a futures contract on German government bond, is 100,000 euros.

intermediaries to buy derivatives packages that they should be able to construct themselves. A potential answer is simply that structured derivatives are a simple method to enhance yield and diversify funds assets, in a way that seemingly does not require any derivatives expertise. This result may also reflect the difficult investment environment in traditional markets in 2004. Most importantly and most obviously, Finnish pension institutions seem largely to use derivatives for other purposes than hedge their risks.

In terms of underlying assets, equity derivatives were most popular, especially on the structured side. Finnish pension institution have also started to use credit derivatives (35% of users), an innovation that barely existed 5 years ago.

Respondents were asked further about their derivatives usage by asking them to indicate how often they have used various common derivatives strategies, or whether they are considering using them. Answers to these questions are presented in the table 6.5.

Table 6.5 - The derivative strategies used

This table presents the derivative strategies Finnish pension institutions reported having used in 2004. 15 institutions reported having used derivatives. These institution were then asked to indicate on five point scale how often they used strategies in the first column. Alternatives were 0 = Not at all, 1 = Not yet, but under consideration, 2 = a couple of times, 3 = occasionally and 4 = frequently.

Strategy	Frequency of use					
	% Used strategy	Not at all	Not yet, but under conside-ration	A couple of times	Occasionally	Frequently
Hedged financial risks using forwards or futures	53%	35%	12%	6%	6%	41%
Used forwards or futures to gain exposure to underlying asset class	41%	41%	18%	18%	6%	18%
Customised your return profile using option contracts	24%	65%	12%	12%	6%	6%
Sold call options to collect premium income	24%	71%	6%	18%	6%	0%
Used swap contracts to manage risk exposure	29%	53%	18%	6%	6%	18%
Bought structured fixed income instruments* to diversify your investments and/or enhance yield to your assets	65%	18%	18%	41%	12%	12%

* unlisted bonds with material derivative component, e.g. principal protected notes with variable coupons, as well as notes with principal payment linked to one or more market variables, or any similar investments

Unexpectedly, the most frequently used strategy is the use of structured derivatives to diversify investments and/or to enhance yield to assets with 65% of derivatives users using them, and another 18% are considering. This result provides contrast to previous studies and common perceptions of pension institutions as users of derivative hedges. It is hard to imagine risks that structured fixed income instruments would hedge better than traditional forwards or futures. This survey clearly reveals that speculative motives have become a major motive for pension institutions to engage into derivative activities. Interesting question also is, to what extent Finnish solvency margin and coverage rules promote the use of structured derivatives. As explained in the section 4.4.4 stand-alone derivatives are not accounted for in the solvency and coverage calculations. Structured derivatives do not have this problem.

This survey also outlines the fundamental difference between structured derivatives and simpler "plain" derivative instruments. Even though many institutions use structured derivatives, they are not traded that frequently. Due to their characteristics, these instruments can be considered more as a buy and hold investments than active derivatives trades. In telephone interviews it was clear that in the difficult investment environment many institution are and have been considering the use of structured derivatives to enhance yield on their fixed income assets. In the survey, 24% of derivatives users had not yet used structured derivatives, but were considering using them.

Naturally, forwards and futures were used as hedges with the 53% of users frequently employing this traditional strategy. Nevertheless, forwards and futures were almost as popular instruments to add on exposure to the underlying asset classes. This further confirms that the use of derivatives to actually increase investment risk, rather than to lower it, is a quite common practice among survey respondents.

Interestingly enough, the use of option strategies has not been very frequent among respondents, as only 12% of users used options occasionally or frequently. This may be due to further complications in the valuation and trading these instruments, as well as costly regulatory compliance.

Table 6.6 - The derivative strategies used by institution type

This table compares the derivative strategies that Finnish pension institutions reported having used in 2004 across institution categories. 15 institutions in total reported having used derivatives, N in column headlines refers to number of institutions using derivatives in that category. % used column presents the proportion of derivative users reported to use strategy, and mean column presents the mean frequency of use as reported on a five point scale. Scale is 0 = Not at all, 1 = Not yet, but under consideration, 2 = a couple of times, 3 = occasionally and 4 = frequently.

Strategy	Pension Insurance Companies (N =5)		Pension Funds (N =10)		Special Pension Institutions (N =2)	
	% Used	Mean	% Used	Mean	% Used	Mean
Hedged financial risks using forwards or futures	80%	3.75	30%	3.33	100%	3.00
Used forwards or futures to gain exposure to underlying asset class	40%	3.50	30%	2.67	100%	3.00
Customised your return profile using option contracts	40%	3.00	0%	N/A	100%	2.00
Sold call options to collect premium income	40%	2.00	10%	3.00	0%	N/A
Used swap contracts to manage risk exposure	40%	3.50	10%	4.00	100%	3.00
Bought structured fixed income instruments* to diversify your investments and/or enhance yield to your assets	60%	2.67	60%	2.50	50%	4.00

* unlisted bonds with material derivative component, e.g. principal protected notes with variable coupons, as well as notes with principal payment linked to one or more market variables, or any similar investments

There are also considerable differences in the way pension institutions use derivatives as demonstrated in the table 6.6. Large pension insurance companies and special pension institutions are frequent users of futures, forwards, and swaps to manager their risk exposures. Insurance companies also use options quite frequently.

Pension funds then again mostly use structured derivatives. As pension funds are significantly smaller and on average less experienced users of derivative instruments, this reflects the significance of scale economies and costs associated with derivative activities.

6.2 Univariate tests

This section uses two independent samples t-test to test for any differences between derivative users and not-users one variable at a time.

6.2.1 Institutional characteristics

As expected, derivatives users are indeed different from institutions that do not use derivatives in terms of their descriptive statistics. These differences are presented in table 7.7

Table 6.7 - Univariate tests for descriptive statistics

This table summarises the t-test for the differences in the descriptive statistics of the derivative users (U) vs. not users (NU). Table reports the hypotheses and test statistics for independent samples t-test. First column defines the variable to be tested and the second column indicates the hypothesed relation in sample means. Third and fourth columns report the sample means, and the fifth column is their difference as U-NU. Finally, last two columns present the associated t-statisc and its p-value for one way test if relationship is hypothesed. Otherwise the test is two way test.
*Stars in the first column indicate statistically significant difference at * 10 percent level, ** 5 percent level, as well as *** 1 percent level.*

Variable	Hypotheses	Users (U) Mean	Not Users (NU) Mean	Difference in means (U-NU)	t-stat	p-value
Assets**	U > NU	€ 4,405,453,875	€ 605,858,294	€ 3,799,595,581	2.031	2.5%
Z-Score* +	U < NU	2.61	3.71	-1.09	1.524	7.0%
Money Market*	U < NU	6.77%	36.54%	-29.76%	1.659	5.4%
Fixed Income	U < NU	38.83%	36.22%	2.61%	0.398	34.7%
Equities	U > NU	30.66%	26.24%	4.42%	0.885	19.1%
Real Estate	-	14.97%	10.59%	4.38%	0.677	25.2%
Lending	-	4.04%	7.14%	-3.11%	0.436	33.3%
Others***	U > NU	5.70%	1.39%	4.31%	2.845	0.4%
Non-euro assets***	U > NU	6.41%	1.55%	4.86%	3.069	0.2%

+ Test for z-score does not include special pension institutions since they do not have solvency margin requirement by law

First, derivative users have significantly larger investment portfolios than not-users. This supports the arguments that derivatives activities have large scale economies, and that the cost of entering the derivatives market may be too high for many smaller institutions. Secondly, derivative users have weaker solvency positions, although evidence on this is not particularly strong. However, this suggests that institutions with weaker solvency position have more incentive to hedge their short-term risks, or to use derivatives to improve their solvency capital.

Finally, these two groups differs in terms of their investment portfolios as expected. Derivative users have significantly more currency risk in their portfolios, as represented by non-euro assets. This may stem from two sources: First, derivatives are used to hedge currency risks. Secondly, same scale economies that may prevent institutions from investing abroad, such as transaction and information costs or lack of investment expertise, may limit their derivative activities. Derivatives users also have higher allocation to alternative assets, such as hedge funds and private equity, as presented by other investments. Not-users have higher money market allocations indicating less risky portfolios on average. Additionally, derivative users have higher equity allocations as hypothesed although statistical evidence is not particularly strong.

6.2.2 Perceptions on the pension institution management and derivative instruments

Table 6.8 presents respondents' perceptions on various statements regarding pension institution's objectives, risks and derivative actitivities. This survey does not find any significant differences between derivatives users and not-users with perceptions relating to pension institutions objectives or risks (as represented by the statements OBJ1-5 and RISK1-5 in table 7.8).

Table 6.8 - Univariate tests for the perceptions on the pension institution management and derivative instruments

This table summarises the t-test for the differences in the perceptions of the derivative users (U) vs. Not users (NU) regarding statements on the pension institution management and derivative instruments. Respondents were asked whether they agree (7) or disagree (1) with the following statements on a seven point Likert scale (1=Disagree, 4=Do not disagree of agree, 7=Agree). First column of the table presents each statement as they were shown to respondents, and second columns names the statement with shorter abbreviation.

Following columns report test statistics for univariate tests of respondents perception. "Sample mean" column indicates mean response from the sample, and its is tested for any differences from 4 (Do not disagree or agree) using one-sample t-test.

Next mean responses from derivative users and not users are compared using two independent samples t-test for any differences. "Hypothesis" column shows if any relationship is hypothesed based on the theory, and following three columns report sample means for the two groups (U for users and NU for not users), and their difference as U-NU. Finally, last two columns present the associated t-statiscs and its p-value. Test is one way test if hypothesed relationships exists,
otherwise two way test for any differences.

*Stars in the columns indicate statistical significance for t-test at * 10 percent level, ** 5 percent level, as well as *** 1 percent level.*

Description	Variable	Sample mean	Hypothesis	Users (U) mean	Not Users (NU) mean	Difference in means (U-NU)	t-stat	p-value
We think that the most important objectives of our								
To deliver highest return for a given level of investment risk	OBJ1	5.77***	-	5.94	5.71	0.23	0.637	52.90%
To invest securely to meet our current and future pension liabilities	OBJ2	5.77***	-	5.69	5.94	-0.25	0.541	59.23%
To minimise contributions needed to finance pensions	OBJ3	5.22***	-	5.06	5.35	-0.29	0.663	51.21%
To minimise investment risks, subject to satisfactory returns	OBJ4	4.13	-	3.88	4.29	-0.42	0.794	43.30%
To fully fund accrued pension liabilities at the lowest possible cost, subject to sensible risk	OBJ5	4.74**	-	4.50	5.00	-0.50	0.896	37.70%
We think that the most important risks to our institution								
Short term financial risk due to uncertain currency fluctuations or returns to our equity and fixed income portfolios	RISK1	3.45*	U>NU	3.25	3.88	-0.63	1.520	13.86%
Uncertain investment returns over longer time horizon	RISK2	5.06***	-	5.00	5.24	-0.24	1.065	29.52%
Deteriorated solvency position or increased contributions due to low investment performance	RISK3	4.54**	U>NU	4.56	4.59	-0.03	0.711	48.27%
Risks that our investment performance is significantly worse than our peers'	RISK4	4.06	U>NU	4.00	4.29	-0.29	1.015	31.79%
Inability to match our assets and liabilities	RISK5	4.45	U>NU	4.31	4.76	-0.45	1.283	20.91%
In the future, we could potentially use derivatives:								
To reduce our short-term financial risks	USE1	4.19	U>NU	4.94	3.76	1.17**	2.309	2.77%
To enhance returns to our asset portfolio	USE2	4.58*	U>NU	5.25	3.82	1.42***	2.956	0.59%
To diversify our portfolio into new asset classes and markets	USE3	4.45	U>NU	5.19	3.76	1.42***	2.733	1.03%
To optimise our porfolio with respect to coverage and solvency regulations	USE4	3.71	U>NU	4.00	3.47	0.53	1.428	16.34%
To time our investments better	USE5	3.52	U>NU	3.75	3.29	0.46	1.263	21.61%
Following factors limit or prevent our derivative activities:								
We can meet our objectives without using derivatives	LIMIT1	4.55*	U<NU	3.81	5.47	-1.66***	3.654	0.09%
Derivatives increase our investment risks	LIMIT2	3.03***	U<NU	2.38	3.88	-1.51***	3.300	0.24%
The cost of using derivatives outweights the benefits to our institution	LIMIT3	3.58	U<NU	2.81	4.65	-1.83***	3.589	0.11%
Our board's lack of knowledge or experience in derivative instruments	LIMIT4	4.35	U<NU	4.06	4.53	-0.47	1.283	20.91%
Current regulatory and accounting treatment and/or our internal rules	LIMIT5	5.12***	U<NU	5.06	4.94	0.12	0.825	41.54%

Overall, all respondents aimed for high returns without forgetting risk considerations. However, risk minimisation was not an objective as statement OBJ4 was not statistically different from 4. Interestingly, this survey confirms that while institutions have long-term investment horizons

(RISK2), short-term risk considerations (RISK1), and solvency calculations (RISK3) have a part in pension institution management. Two groups did not differ with respect to these statements.

Respondents were also asked to provide opinion on potential ways to use derivatives and which factor limit their derivative activities. Here the interest is how the two groups differ. Derivatives are used to hedge short-term risks (USE1), enhance returns (USE2) as well as diversify assets to new markets (USE3). These survey results support hypotheses 1,2 and 3. However, on aggregate derivatives seem not be used for regulatory arbitrage since the two groups did not differ on this dimension (USE4 and USE5). Hypotheses 4 may thus be rejected at this stage.

Institutions that do not use derivatives, think more strongly that they can meet their objectives without using derivatives (LIMIT1), derivatives increase their investment risks (LIMIT2) and that the cost of using derivatives outweighs the benefits (LIMIT3). This clearly supports hypotheses 5 and 6. Results are in line with the pension institution literature and previous empirical evidence.

Respondents were also asked to indicate their agreement with statements on the use of derivatives. Their responses are summarised in the table 7.9.

First, in general respondents think that derivatives can help to access some markets (YIELD1), to time investments (YIELD2) and to allocate capital passively (ALLOCATION1), these issues do not differentiate derivative users from not-users. Nevertheless, this does not necessarily erode the support found for hypotheses 1,2, and 3. Simply put, not-users may realise the potential benefits of the derivative instruments, but some factors prevent them actually using them deteriorating the statistical difference between the two groups.

Secondly, both groups report disagreement with statements testing motivations for regulatory arbitrage (REGARB 1 and 2). On average, current regulations seem not to form a major obstacle to use derivatives (REG1). On the other hand, respondents think that coverage and solvency margin rules do not promote the use of derivatives (REG2). This further supports the rejection of hypothesis 4

As a further confirmation for hypothesis 5, institutions that do not use derivatives indicate that they can match their assets better with traditional investments than derivative users (NONEED2).

Additionally, not-users also report that they have more difficulties in valuing certain derivative positions adding to the cost of using these instruments (COST1). Lack of qualified personnel also seems to be more an issue with institutions that do not use derivatives, but evidence on this is statistically weaker (COST2). This evidence further supports the acceptance of hypothesis 5.

Table 6.9 - Univariate tests for the perceptions on the derivative instruments

This table summarises the t-test for the differences in the perceptions of the derivative users (U) vs. Not users (NU) regarding statements on the pension institution management and derivative instruments. Respondents were asked whether they agree (7) or disagree (1) with the following statements on a seven point Likert scale. First column of the table presents each statement as they were shown to respondents, and second columns names the statement with shorter abbreviation.

Following columns report test statistics for univariate tests of respondents perception. "Sample mean" column indicates mean response from the sample, and its is tested for any differences from 4 (Do not disagree or agree) using one-sample t-test.

Following columns report test statistics for two independent samples t-test for the differences in the mean scoring of the two groups. Fifth and sixth columns report the group means, and the seventh column is their difference as U-NU. Finally, last two columns present the associated t-statiscs and its p-value. Test is one way test if hypothesed relationship exists, otherwise a two way test for any differences.

*Stars in the columns indicate statistically significant difference at * 10 percent level, ** 5 percent level, as well as *** 1 percent level.*

Statement	Variable	Sample mean	Hypothesis	Users (U) mean	Not Users (NU) mean	Difference in means (U-NU)	t-stat	p-value
Derivatives give a better access to some markets	YIELD1	5.25***	U>NU	5.44	5.00	0.44*	1.75	9.06%
Derivatives improve the liquidity of investments	YIELD2	4.80***	U>NU	4.94	4.47	0.47	1.38	17.76%
Derivative structures, such as investments linked to equity indexes, are a good way to invest passively in the markets	ALLOCATION1	4.65**	U>NU	4.56	4.82	-0.26	1.00	32.38%
Derivatives increase the flexibility to plan and manage taxes	REGARB1	3.35***	U>NU	3.38	3.29	0.08	0.81	42.44%
Derivatives help to improve the solvency margin (toimintapääoma)	REGARB2	3.48**	U>NU	3.63	3.29	0.33	1.13	26.75%
Nature of our business is such that we are not exposed to significant financial risks	NONEED1	2.97***	U<NU	2.38	3.88	-1.51***	2.75	1.00%
We can match our assets and liabilities very well using traditional investments	NONEED2	4.68**	U<NU	4.00	5.53	-1.53***	3.42	0.18%
We are not interested in exploiting short term (less than 6 months) market views	NONEED3	4.19	U<NU	4.06	4.41	-0.35	-1.10	28.12%
We limit the use of derivatives to hedge our risks, because timing of such strategies is always uncertain, and hence risks losing money	INCRISKS1	4.06	U<NU	3.69	4.06	-0.37***	3.00	0.53%
Pension institutions invest their assets in safe investments. Derivatives have an image of riskiness	INCRISKS2	3.35*	U<NU	2.88	4.06	-1.18**	2.28	2.99%
Use of derivatives involves complex risks, and sensible pension institution managers need to avoid using these instruments	INCRISKS3	3.23**	U<NU	2.56	4.06	-1.50***	3.11	0.40%
We find it difficult to value certain derivatives positions	COST1	4.29	U<NU	3.88	4.76	-0.89**	2.06	4.83%
Lack of qualified personnel is a major issue in derivative activities	COST2	4.22	U<NU	3.88	4.47	-0.60	1.44	15.85%
Current solvency margin and coverage regulations (toimintapääoma- ja vakavaraisuussäännökset) promote the use of derivatives	REG1	3.51*	U>NU	3.25	3.71	-0.46	1.39	17.38%
Current regulatory limitations on the use of derivatives represent a major obstacle to use these instruments	REG2	4.52	U<NU	4.44	4.41	0.03	0.71	48.33%

Finally, significant differences are found in the perceived risk in the derivative instruments. Institution that do not use derivatives think more that pension institutions should not use

derivatives due to the complex risks involved (INCRISK3). They also agreed more often that derivatives have "an image of riskiness" (INCRISK2). Similarly to Puttonen and Torstila (2003), timing of the hedging strategies seems to be an issue for institution not using derivatives (INCRISK1). These results support the acceptance of hypothesis 6.

6.3 Correlations and principal components

Before testing the joint effect of the variables, their interaction is examined. For this analysis, only statistically different descriptive variables that directly measure hypotheses are selected. Of the statements relating to motivations and limitations institutions have: USE1 (hypotheses 1), USE2 (hypotheses 3), USE3 (hypotheses 2), LIMIT1 and LIMIT3 (hypotheses 5), LIMIT2 (hypotheses 6) are included. Of the descriptive data, Assets (measuring scale economies), solvency position (Z-score), money market allocation (portfolio risk) and investments in other currencies (portfolio risk) are selected. Table 7.10 represents correlations among these variables.

Table 6.10 - Correlations between differentiating variables

This table reports pearson correlation coefficients between variables that are statistically significant in t-tests for the group means between derivative users and not-users.

*Stars in the columns indicate statistically significant correlations (2-tailed) at * 10 percent level, ** 5 percent level, as well as *** 1 percent level.*

	Assets	Z	MM	FX	USE1	USE2	USE3	LIMIT1	LIMIT2	LIMIT3
Assets	1.00									
Z	-0.15	1.00								
MM	-0.21	-0.06	1.00							
EQT	0.42**	-0.14	-0.29*	1.00						
USE1	0.06	-0.09	-0.25	0.33	1.00					
USE2	0.39**	0.03	-0.17	0.40**	0.40**	1.00				
USE3	0.29	-0.19	-0.10	0.37**	0.25	0.74***	1.00			
LIMIT1	-0.32*	0.21	-0.04	-0.13	-0.29*	-0.47***	-0.25	1.00		
LIMIT2	-0.36**	0.33	0.05	-0.38**	-0.29*	-0.52***	-0.33*	0.73***	1.00	
LIMIT3	-0.35**	0.23	0.05	-0.35**	-0.11	-0.31*	-0.27	0.67***	0.59***	1.00

As shown in the table amount of money market allocation does not correlate with other variables. Similarly, solvency position hardly correlates with any other variables. However, assets and investments in other currencies correlate with each other and with many statements relating to motivations and limitations institutions have in the derivatives market.

Moreover, variables measuring institutions' perceptions correlate with each other. These correlations are likely to cause multicollineriaty problems in regression analysis and have to be accounted for.

Principal components analysis is used to correct the data for these correlations. As non-correlated variables Z-score and EQT are not included in this analysis. Table 6.11 presents the results.

Table 6.11 - Components of motives and limitations to use derivatives

This table reports the results of principal component analysis for correlated variables in table 7.10., i.e. FX = allocation to non-euro assets, Assets = total value of investment portfolio, USE1, 2, and 3 = statements relating to the motives to use derivatives, as well as LIMIT1,2 and 3 = statements relating to factors that limit derivative activities. Correlation matrix reports correlation coefficients among variables included in the analysis. Additionally, KMO measure of sampling adequacy for the variables as well as Bartlett's test for sphericity of the correlation matrix are reported.

Secondly, table reports the percentage of variance accounted by the factors extracted from the data. "Initial eigenvalues" presents results for all factors extracted. "Extraction sums of squared loadings" columns give the variances associated with factors that are retained. "Rotation sums of squared loadings" report the explained variance after the varimax rotation.

Finally, component score coefficient matrix presents the weights used to combine original variables as factors characterising Finnish pension institution's motivations and limitations in the derivatives market.

Component Score Coefficient Matrix

	Components	
	1	2
fx	0.38	0.18
assets	0.17	-0.04
use1	0.20	0.00
use2	0.34	0.05
use3	0.39	0.14
limit1	0.17	0.47
limit2	0.03	0.35
limit3	0.12	0.39

Kaiser-Meyer-Olkin measure of sampling adequacy		0.67
Bartlett's test of sphericity	Chi-Sq	97.64
	df	28.00
	p-value	0.00

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.64	45.55	45.55	3.64	45.55	45.55	2.50	31.30	31.30
2	1.24	15.46	61.01	1.24	15.46	61.01	2.38	29.71	61.01
3	0.97	12.12	73.13						
4	0.82	10.31	83.43						
5	0.56	7.00	90.43						
6	0.41	5.17	95.60						
7	0.21	2.57	98.17						
8	0.15	1.83	100.00						

Extraction Method: Principal Component Analysis.

Correlations between variables FX, Assets, USE1, USE2, USE3, LIMIT1, LIMIT2 and LIMIT3 are statistically significant. Bartlett's test of sphericity verifies that the population correlation

matrix is not identity matrix, and principal components analysis is thus correct method to continue. Additionally, Kaires-Meyer-Olkin measure of sampling adequacy verifies, i.e. it is larger than 0.50, that the correlations between pairs of variables can be explained by common components.

In this study principal component analysis is used to determine minimum number of factors that would account for maximum variance in the data for use in subsequent multivariate analysis. Using varimax rotation two components were extracted. These two components account for 61% of the variance in the data, and they can be interpreted using "Component score coefficient matrix" panel in the table 6.11.

Component 1 scores high on variables FX (Institutions investments in other currencies), Assets (Total size of investment portfolio), and for USE1, USE2 and USE3 (measure positive perceptions on the derivatives instruments. Component 1 can be thus characterised as a measure of institutions motives to use derivatives, and appropriately named as MOTIVES for subsequent analysis.

Component 2 on the other hand scores higher on variables LIMIT1, LIMIT2 and LIMIT3 that measure limitations on the derivative activities. Additionally, other variables score low or even negatively in the case of "Assets". Component 2 thus measures limitations on the institutions' derivatives investments and is appropriately named as LIMITATIONS for subsequent analysis.

Next these components are used in regression analysis to test the hypotheses in multivariate environment

6.4 Multivariate tests

In this section the hypotheses of this study are tested in the multivariate environment, and the interaction between the variables is examined.

6.4.1 Participation decision

Objective of this section is to test which factors affect institutions decision to participate the derivatives market in the first place.

The fitted models are as follows:

$$p_i = F(USER_i) = \frac{1}{1+e^{-USER_i}}$$

, where

$$USER_i = \beta_1 + \beta_2 * MOTIVES + \beta_3 * LIMITATIONS + \beta_4 * MM \quad (1)$$

, and

$$USER_i = \beta_1 + \beta_2 * MOTIVES + \beta_3 * LIMITATIONS + \beta_4 * MM + \beta_5 * Z \quad (2)$$

, for both models

MOTIVES=0.38*FX+0.17*ASSETS+0.20*USE1+0.34*USE2+0.39*USE3+0.17*LIMIT1+0.03*LIMIT2+0.12*LIMIT3

LIMITATIONS=0.18*FX-0.04*ASSETS+0.00*USE1+0.05*USE2+0.14*USE3+0.47*LIMIT1+0.35*LIMIT2+0.39*LIMIT3

The dependent variable is the probability that the institution had used derivatives in 2004. USER is binary, so that 1 indicates that institution had used derivatives and 0 that it had not used them. MOTIVATIONS and LIMITATIONS are variables obtained with principal component analysis.

First, table 6.12 reports the results for regression model (1) and (2). Both regression models are statistically significant and categorise 78.8% and 75%, respectively, of the institutions correctly as derivatives users and not-users.

Table 6.12 - Determinants of the use of derivatives by Finnish pension institutions

This table reports the results of binary logistic regressions to analyse the insitution's decision to use derivatives. Dependent variable is "user", i.e. 0 if institution had not used derivatives in 2004, and 1 if institution had used derivatives in 2004. In the binary logistic regression specifications (1) and (2) the observations are the responses to the survey. In the second regression special pension institutions are omitted because they do not have solvency requirements defined by law.

First panel reports the variable co-efficients and their p-value in a two-way test for their Wald-statistics. Second panel reports the summary statistics for the regression models.

Dependent variable: Dummy for the use of derivatives

	Regression 1		Regression 2	
	Beta	p-value	Beta	p-value
Constant	0.00	1.00	0.30	0.73
MOTIVES-factor	1.33	0.02	1.70	0.03
LIMITATIONS-factor	-1.42	0.01	-1.53	0.06
Money Market	1.54	0.53	0.93	0.73
Z-Score	-	-	0.09	0.42

p-value	0.00	0.02
-2 Log Likelyhood	30.55	20.25
Cox and Snell R-Sq	0.37	0.40
% Correct	78.80	75.00
N	33	26

Variables measuring institutions motives to use derivatives are statistically significant in both regressions at 5% level. As expected, more motives to use derivatives institutions have, the more likely they are to be classified as derivative users. Opposite is true for limitations. However, statistical evidence is weaker if z-score is included. Institution's equity allocation and solvency position do not appear to be significant factors in the decision to use derivatives or not.

As expected, and similarly to univariate analysis, regression results support hypotheses 1,2,3,5 and 6. Potential motives and limitations explain whether institutions use derivatives or not. Derivatives are used to hedge risks, diversify assets and to enhance yields. Costs of using derivatives and perceived risks may prevent some institutions from using derivatives.

6.4.2 Volume decision

This section tests do the variables explain how much the Finnish institutions use derivatives. Notional value of institutions outstanding derivatives position (NOT), as percentage of their total

investment portfolio, is used as a proxy variable on the volume of their derivatives trading. Institutions that had not used derivatives in 2004 are excluded from this analysis.

Fitted models are:

$$NOT_i = \beta_1 + \beta_2 * MOTIVES + \beta_3 * LIMITATIONS + \beta_4 * MM \quad (3)$$

, and

$$NOT_i = \beta_1 + \beta_2 * MOTIVES + \beta_3 * LIMITATIONS + \beta_4 * MM + \beta_5 * Z \quad (4)$$

, where

MOTIVES=0.38*FX+0.17*ASSETS+0.20*USE1+0.34*USE2+0.39*USE3+0.17*LIMIT1+0.03*LIMIT2+0.12*LIMIT3

LIMITATIONS=0.18*FX-0.04*ASSETS+0.00*USE1+0.05*USE2+0.14*USE3+0.47*LIMIT1+0.35*LIMIT2+0.39*LIMIT3

Table 6.13 presents the results. Models do not provide especially good fit with the data with R-squared of 47.5% and 48%. Model (4) cannot be regarded as statistically significant at 10% level. Nevertheless, z-score does not show any more significance as in the participation decision, and nothing suggests that it would have any impact on institution's derivative activities on average.

Interesting result is that, as a contrast to participation decision, volume of derivative activities seem to be better explained by the limitations that institution face: the cost of using them, such as expertise and systems, and perceived investment risks. LIMITATIONS is statistically significant at 1% level, but evidence for MOTIVES is statistically weaker. Similarly to participation decision, amount of money market allocation does not have an effect. This confirms acceptance of hypotheses 5 and 6.

Table 6.13 - Determinants of the volume of the derivative activities by Finnish pension institutions

This table reports the results of linear regression to analyse the insitution's decision on the volume of their derivatives activities. Dependent variable is "NOT", i.e. sum of notional values of institutions outstanding derivative position as of 31/12/2004. In the OLS-regressions specifications (3) and (4) the observations are the responses to the survey. Institutions that had not used derivatives in 2004 are excluded from the model In the second regression also special pension institutions are omitted because they do not have solvency requirements defined by law

First panel presents the variable coefficients in the regression model and their p-value for a two way t-test. Second panel reports summary statistics for both models.

Dependent variable: Sum of notional values of derivatives positions on 31/12/2004 as a percentage of market value of the total investment portfolio

	Regression 3		Regression 4	
	Beta	p-value	Beta	p-value
Constant	0.07	0.03	0.12	0.04
MOTIVES-factor	0.02	0.40	0.03	0.29
LIMITATIONS-factor	-0.07	0.00	-0.09	0.01
Money Market	-0.51	0.05	-1.98	0.03
Z-Score	-	-	0.00	0.92
R-squared	0.59		0.74	
p-value	0.01		0.02	
N	16		14	

6.5 Discussion of the results

6.5.1 Survey design

As Malthotra and Birks (2003) point out, the great weakness of questionnaire design is lack of theory. Because there are no scientific principles that guarantee an optimal or ideal questionnaire, questionnaire design in this survey is affected by the experience and subjective judgment of the researcher. This survey was designed to provide data for the purposes of this study based on the extensive pension institution literature, but there are no guarantees that all relevant information has been collected. Additionally, measurement error may arise in a sense that survey questions may not necessary have measured issues they were supposed to measure.

6.5.2 Non-response bias

Although this survey was well received and response rate was relatively high compared to similar surveys abroad, survey results may be somewhat biased because all institutions in the

population did not participate. This non-response biased arises since non-respondents may differ from respondents in terms of their characteristics and perceptions on the derivative activities.

In this survey, institutions that choose not to participate in the survey were mainly smaller pension funds. Based on the survey results these smaller institutions are less likely to use derivatives. Consequently, actual proportion of institutions using derivatives may be somewhat lower.

However, respondents of this survey presents 92% of the assets under management in the Finnish pension sector, and in this sense survey sample may be regarded as comprehensive, and results may be generalised to whole population. Hence responses were not corrected for non-response bias since this would have introduced another element of researcher's judgment into the results.

6.5.3 Response error

Response error arises when respondents give inaccurate answers or their answers are mis-recorded. In this study, respondents most likely filled their answers in their offices and surrounding environment may have affected the accuracy of their answers. Secondly, questionnaire was sent out in English to mainly native Finnish respondents. Even though no respondents reported having any language problems, there may have been misunderstandings that may contribute to total response error. However, as survey results make perfect sense and provide good data to test the hypotheses in this survey, these response errors may cancel out in the sample data.

6.5.4 Robustness of the survey results

Due to the small population size, 61 institutions, survey sample is a relatively small in statistical sense with 33 institutions. This means that while being sufficient for statistical tests, statistical estimates and their significance levels are most likely not especially robust. In other words, a few more respondents with extreme characteristics and views could significantly affect the survey results. Additionally, since only 16 institutions were characterized as derivative users, this problem is even more pronounced in the OLS-regressions

6.5.5 Equal weighting

Considering overall perceptions of the Finnish pension institutions, a question on the weighting the responses with institution's size arises. In this survey, all responses were equally weighted, meaning that responses from small pension funds were equally important as responses from the large pension insurance companies. This choice was made because the focus was to study the institutional characteristics and perception that affect the decision to use derivatives.

However, at least from the regulatory point of view, it would be more of an interest to weigh the responses with institution's size. This would further outline the importance of derivative instruments and strategies for efficient pension institution management, as well as the need for optimal regulation for all institutions.

6.5.6 Other limitations

Finally, responses to this survey provide only a static snapshot on the characteristics and perceptions of the Finnish pension institutions in the spring 2005. As such, the results may be difficult to generalise over time. In this sense, it could be useful to conduct a follow up study on these issues in the future.

7 Conclusions

This study presents a comprehensive analysis of the previously undisclosed derivative activities of the Finnish pension institutions. Motives and limitations that drive these activities are also examined.

Results of the study are based on the survey "2005 Survey of Derivatives Usage by Finnish Pension Institutions" conducted as an email questionnaire supported by telephone interviews in March – April 2005. Of the 61 pension institutions included in the survey population, 33 institutions choose to participate in the survey. With 80.8 billion euros of investment assets, participating institutions present 92% of the assets in the Finnish pension sector. Consequently, this study gives a representative overview on the derivative activities of the Finnish pension sector.

Survey was designed to explore 1) What characteristics differentiate those institutions that use derivatives from those that do not use? 2) What derivative instruments Finnish pension institutions use, and what derivative strategies they have utilised? 3) What motivates pension institutions to use derivatives, and why some institutions are not using them at all? On the basis of the existing literature, these objectives were characterised as 5 hypotheses that were tested with the data obtained in the survey. Findings of this study reveal several new insights on the pension sector's derivative activities.

First of all, survey results confirm that Finnish pension institutions are active players in the derivatives markets. 52% of the respondents were using derivatives, and 87% of the pension assets are in institutions that use derivatives. These results are in line with previous surveys in the US and Europe, and confirm that at least Finnish pension institution are not less active derivative users that their international peers. More importantly, results suggest that derivatives are one important aspect of pension institution management and asset allocation decisions. Pension institutions need managers that have the expertise to make informed decisions whether to use derivatives and how to use them.

Secondly, this survey challenges the traditional and regulatory view of derivatives as instruments mainly used for hedging purposes. While 53% of derivative users were employing forward and futures hedges, 41% of users were using the same instruments to gain more exposure to underlying asset classes. Even more surprising was that the most popular derivative strategy was the use of structured derivatives to diversify assets and/or to enhance yield to investments. Statistical analysis of the respondents perceptions confirms that the use of derivatives is motivated by the need to hedge risks, but also the search for better yields and asset allocation. However, this study does not find any evidence that derivatives would be used to arbitrage Finnish regulatory framework.

Thirdly, survey responses outline the importance of the costs involved with derivative activities, as well as the perceived risks that these instruments have. For many institutions the decision not to use derivatives may be completely rational if the costs involved, such as lack of expertise and resources, outweigh the expected benefits. Additionally, the decision how much to use derivatives is better explained by these perceived limitations than with motives mentioned above.

Costs of using derivatives may also be one reason that explains the popularity of structured derivatives among Finnish pension institutions, as many of the structured instruments can be used traditionally as buy and hold investments. Major question is if the nature of these instruments is fully understood by all pension managers. Discussions with Finnish pension institutions revealed that many managers do not even consider these instruments as derivatives. However, even in the simplest instruments the value of the derivative component may be substantial. Consequently, one area for further practical research in the field could be risk management and operational issues in smaller pension funds. Especially, coherent analysis on the relation between Finnish pension system and corporate risk management and valuation may be needed.

More importantly, there is a need to establish a clear link between the asset-liability management framework and pension institutions derivative strategies. Fundamental question is what kind of derivative strategies and instruments would be optimal for institutions with different liability structures. Answer to this question would provide more understanding on whether pension institutions should use derivatives in the first place.

Finally, Alestalo and Puttonen (2004) call for extension of this type of coherent asset-liability management framework into the pension sector's regulation in Finland. Findings of this survey emphasise the need for similar public discussion on how to optimally regulate pension sector's derivative activities in the context of rapidly developing financial innovations. New innovations can quickly make regulatory limits inefficient. Interesting academic and practical issue thus is, do current Finnish solvency capital and coverage rules promote the use of structured derivative products, or is their popularity driven by other factors such as costs and expertise.

Given the diverse characteristics of the Finnish pension institutions, one-size fits all approach to regulation is unlikely to be optimal. Less regulation and more public disclosure may be needed to ensure that institutions are using derivatives optimally to the benefit of future pensioners.

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Appendix 1 - List of variables used in multivariate analysis

This table summarises and describes the variables used in the multivariate analysis

Variable	Description
Assets	Total market value in euros of the institution's investment portfolio as of 31/12/2004.
Z	Institution's solvency margin/solvency limit - ratio. Also known as Z-score or solvency position.
MM	Proportional allocation to money market instruments, I.e. fixed income investments with less than one year to maturity
FX	Proportional allocation to any investments that are denominated in other currencies than euro
USE1	Agreement on scale of 1 (disagree) to 7 (agree) with statement "In the future, we could potentially use derivatives to reduce our short-term financial risks"
USE2	Agreement on scale of 1 (disagree) to 7 (agree) with statement "In the future, we could potentially use derivatives toenhance return to our asset portfolio"
USE3	Agreement on scale of 1 (disagree) to 7 (agree) with statement "In the future, we could potentially use derivatives to diversify our asset portfolio to new assets and markets"
LIMIT1	Agreement on scale of 1 (disagree) to 7 (agree) with statement "Following factor limit our derivative activities: We can meet our objectives withoout using derivatives"
LIMIT2	Agreement on scale of 1 (disagree) to 7 (agree) with statement "Following factor limit our derivative activities: Derivatives increase our investment risk"
LIMIT3	Agreement on scale of 1 (disagree) to 7 (agree) with statement "Following factor limit our derivative activities: The cost of using derivatives outweighs the benefits to our institution"
MOTIVES-factor	0.38*FX+0.17*ASSETS+0.20*USE1+0.34*USE2+0.39*USE3+0.17*LIMIT1+0.03*LIMIT2+0.12*LIMIT3
LIMITATIONS-factor	0.18*FX-0.04*ASSETS+0.00*USE1+0.05*USE2+0.14*USE3+0.47*LIMIT1+0.35*LIMIT2+0.39*LIMIT3

2005 Survey of Derivatives Usage by Finnish Pension Institutions

This questionnaire is a part of the study on the derivatives usage by Finnish pension institutions conducted by Helsinki School of Economics, Faculty of Finance. The purpose of this research is to explore how and why Finnish pension investors use derivatives. Motivations, strategies and risks underlying pension sector's derivative activities are generally not very well understood by many practitioners, academics, nor regulators. This study aims to address these issues.

This research would not be possible without your contribution, so please answer the following questions and return the form by Wednesday 30/3/2005. It takes maximum **fifteen minutes to complete** this questionnaire.

Summary of the research results will be sent to all respondents in May - June 2005, and this information helps you to evaluate and develop your institution's derivative policy and activities. Additionally, all responses will take part in the lottery and you have **a good chance to win one of the two champagne bottles**.

All responses are used strictly for the academic purposes of this study, and individual **responses will not be forwarded** to any third parties. For further information, please contact:

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PART I – Respondent information

Question 1 – What position do you hold in your institution?

Question 2 – What are your main responsibilities? (Please click all that apply)

Directly responsible for institution's investment performance
Participated in the formulation of institution's investment and derivatives policy
Responsible for implementing and administrating institution's derivative activities

Question 3 – Do you wish to receive summary on the findings of this study, and participate in the champagne lottery?

YES, my email address is: NO

Research summaries will be sent in May-June 2005 via email. Lottery winners will be personally contacted in May 2005.

Please turn to page two

PART II – Descriptive statistics

Following questions collect descriptive statistics on the investment operations of Finnish pension institutions. Please answer to the best of your knowledge by writing your answers to the text boxes, and by left-clicking relevant check boxes.

Question 4 – What was the total market value of your investment portfolio as of 31/12/2004 (with 1,000 € accuracy)?

Question 5 - What was your solvency margin/solvency limit - ratio (toimintapääoma jaettuna vakavaraisuusasetuksen mukaisella vähimmäismäärällä) as of 31/12/2004 (with 2 decimals accuracy)?

Question 6 – What was the asset allocation of your investment portfolio as of 31/12/2004? Please write in the boxes the amount of investments in each category as proportion of your total portfolio.

		% of total assets	Explanation
6.1	Money market		Cash and fixed income investments with less than 1 year maturity
6.2	Fixed Income		Bonds with maturity more then 1 year
6.3	Equities		All listed equity investments
6.4	Real estate assets		Real estate, land, timber and related investments
6.5	Lending		Loans to real estate companies, corporations or equivalents
6.6	Other investments		Investments to unlisted companies, hedge funds, bonds with substantial derivative component or any other investments not categorised above
		100%	
6.7	Investments in other currencies		Total investments to assets denominated in other currencies than euro

Question 7 – Is the use of derivatives permitted in your institution? Yes No

Question 8 – Did you use derivatives in 2004? Yes No

If you answered "No" to question 8, please turn to part IV on page four.

Please turn to page three

PART III – The Use of Derivatives by Finnish Pension Institutions

Following questions collect descriptive statistics on the use of derivatives by Finnish pension institutions. Please answer to the best of your knowledge by left-clicking relevant check boxes.

Question 9 – Which of the following derivative instruments you used in 2004? Please also indicate the underlying asset class.

		FX	Interest rates*	Equity	Credit**	Other, please indicate
9.1	Exchange traded futures on					
9.2	Over-the-counter forwards on					
9.3	Exchange traded options on					
9.4	Over-the-counter options on					
9.5	Swaps on					
9.6	Structured fixed income instruments*** which have coupon or principal payment totally, or partly linked to					

*Government bonds or other benchmark rates

**Corporate bonds or equivalent

*** unlisted bonds with material derivative component, e.g. principal protected notes with variable coupons, as well as notes with principal payment linked to one or more market variables, or any similar investments

Question 10 – Please indicate total notional value* of your outstanding derivative positions as percentage of your total investment portfolio as of 31/12/2004:

**Sum of notional values of all outstanding derivative positions*

Question 11 – Did you use any of the following derivative strategies in 2004? Please also indicate how often you used the strategy in question.

	Strategy	Not at all	Not yet, but under conside-ration	A couple of times	Occasionally	Frequently
11.1	Hedged financial risks using forwards or futures					
11.2	Used forwards or futures to gain exposure to underlying asset class					
11.3	Customised your return profile using option contracts					
11.4	Sold call options to collect premium income					
11.5	Used swap contracts to manage risk exposure					
11.6	Bought structured fixed income instruments* to diversify your investments and/or enhance yield to your assets					

* unlisted bonds with material derivative component, e.g. principal protected notes with variable coupons, as well as notes with principal payment linked to one or more market variables, or any similar investments

Please turn to page four

PART IV – Perceptions on the pension institution management and derivative instruments

Listed below are different statements regarding your views on pension institution management and derivative instruments. Please indicate how strongly you agree or disagree with each statement on the scale from 1 (disagree) to 7 (agree) by left-clicking the check box on the top of relevant number. Answer to the best of your knowledge, regardless of whether your institution uses derivatives or not.

		Disagree			Neither agree or disagree			Agree
12.	We think that the most important objectives of our investment policy are:							
12.1	To deliver highest return for a given level of investment risk	1	2	3	4	5	6	7
12.2	To invest securely to meet our current and future pension liabilities	1	2	3	4	5	6	7
12.3	To minimise contributions needed to finance pensions	1	2	3	4	5	6	7
12.4	To minimise investment risks, subject to satisfactory returns	1	2	3	4	5	6	7
12.5	To fully fund accrued pension liabilities at the lowest possible cost, subject to sensible risk	1	2	3	4	5	6	7
13.	We think that the most important risks to our institution are:							
13.1	Short term financial risk due to uncertain currency fluctuations or returns to our equity and fixed income portfolios	1	2	3	4	5	6	7
13.2	Uncertain investment returns over longer time horizon	1	2	3	4	5	6	7
13.3	Deteriorated solvency position or increased contributions due to low investment performance	1	2	3	4	5	6	7
13.4	Risks that our investment performance is significantly worse than our peers'	1	2	3	4	5	6	7
13.5	Inability to match our assets and liabilities	1	2	3	4	5	6	7
14.	In the future, we could potentially use derivatives:							
14.1	To reduce our short-term financial risks	1	2	3	4	5	6	7
14.2	To enhance returns to our asset portfolio	1	2	3	4	5	6	7
14.3	To diversify our portfolio into new asset classes and markets	1	2	3	4	5	6	7
14.4	To optimise our porfolio with respect to coverage and solvency regulations	1	2	3	4	5	6	7
14.5	To time our investments better	1	2	3	4	5	6	7
15.	Following factors limit or prevent our derivative activities:							
15.1	We can meet our objectives without using derivatives	1	2	3	4	5	6	7
15.2	Derivatives increase our investment risks	1	2	3	4	5	6	7
15.3	The cost of using derivatives outweights the benefits to our institution	1	2	3	4	5	6	7
15.4	Our board's lack of knowledge or experience in derivative instruments	1	2	3	4	5	6	7
15.5	Current regulatory and accounting treatment and/or our internal rules	1	2	3	4	5	6	7

Please turn to page five

Part V – Perceptions on the use of derivatives

Listed below are different statements regarding your investment policy and use of derivatives. Please indicate how strongly you agree or disagree with each statement on the scale from 1 (disagree) to 7 (agree) by left-clicking the check box on the top of relevant number. Answer to the best of your knowledge, regardless of whether your institution uses derivatives or not.

	Disagree			Neither agree or disagree			Agree
16. Derivatives give a better access to some markets	1	2	3	4	5	6	7
17. Derivatives improve the liquidity of investments	1	2	3	4	5	6	7
18. Derivative structures, such as investments linked to equity indexes, are a good way to invest passively in the markets	1	2	3	4	5	6	7
19. Derivatives increase the flexibility to plan and manage taxes	1	2	3	4	5	6	7
20. Derivatives help to improve the solvency margin (toimintapääoma)	1	2	3	4	5	6	7
21. Nature of our business is such that we are not exposed to significant financial risks	1	2	3	4	5	6	7
22. We can match our assets and liabilities very well using traditional investments	1	2	3	4	5	6	7
23. We are not interested in exploiting short term (less than 6 months) market views	1	2	3	4	5	6	7
24. We limit the use of derivatives to hedge our risks, because timing of such strategies is always uncertain, and hence risks losing money	1	2	3	4	5	6	7
25. Pension institutions invest their assets in safe investments. Derivatives have an image of riskiness	1	2	3	4	5	6	7
26. Use of derivatives involves complex risks, and sensible pension institution managers need to avoid using these instruments	1	2	3	4	5	6	7
27. We find it difficult to value certain derivatives positions	1	2	3	4	5	6	7
28. Lack of qualified personnel is a major issue in derivative activities	1	2	3	4	5	6	7
29. Current solvency margin and coverage regulations (toimintapääoma- ja vakavaraisuussäännökset) promote the use of derivatives	1	2	3	4	5	6	7
30. Current regulatory limitations on the use of derivatives represent a major obstacle to use these instruments	1	2	3	4	5	6	7

We thank you for your time and effort.

Please save this form and email to: teemu.hyvonen@ky.hkkk.fi